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1896-97

University Bulletins — Series 1. Number 5

THE LIBRARY
OF THE
UNIVERSITY OF ILLINOIS

OHIO STATE UNIVERSITY

The College of Engineering

1896-1897

The State has no material resources at all comparable with its citizens, and no hope of perpetuity except in the intelligence and integrity of its people.

COLUMBUS
PUBLISHED BY THE UNIVERSITY
MAY, 1896

Civil Eng. is on page 11

THE UNIVERSITY BULLETINS are issued monthly, nine numbers in each year.
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Days and Dates

1896

Entrance Examinations (8 A. M.) and Registration	Monday, Tuesday, Wednesday,	September 14. September 15. September 16.
Lectures and Class-work begin (all Colleges)	Thursday,	September 17.
Thanksgiving Recess	Thursday, Friday,	November 26. November 27.
First Term ends	Wednesday,	December 23.
Christmas Vacation.		

1897

Second Term begins	Wednesday,	January 6.
First Semester (College of Arts, Philosophy and Science) ends	Friday,	February 5.
Second Semester (College of Arts, Philosophy and Science) begins	Monday,	February 8.
University Day	Saturday,	February 22.
Second Term ends	Friday,	March 26.
Third Term begins	Monday,	March 29.
Spring Recess.		
High School Day	Friday,	May 21.
Senior Vacation begins	Saturday,	May 22.
Field Day—Athletic Association	Saturday,	May 22.
Competitive Drill, Cadet Battalion	Saturday,	June 4.
Final Examinations (all Colleges)	Monday, Friday,	June 6. June 11.
Baccalaureate Sermon	Sunday,	June 13.
Entrance Examinations (8 A. M.)	Monday, Tuesday,	June 14. June 15.
Class Day	Monday,	June 14.
Alumni Day	Tuesday,	June 15.
COMMENCEMENT	Wednesday,	June 16.

The College of Engineering

ENROLLMENT FOR 1895-96

Course in Civil Engineering	78
Course in Electrical Engineering	138
Course in Mechanical Engineering	41
Course in Mining Engineering	25
Course in Mining (Short)	12
Course in Industrial Arts	5
Course in Ceramics	15
Total	314

College of Engineering

FACULTY

JAMES HULME CANFIELD, M. A., LL. D.........University Grounds
President

NATHANIEL WRIGHT LORD, E. M., Dean....338 West Eighth avenue
Professor of Metallurgy and Mineralogy and Director of the School of Mines

EDWARD ORTON, Ph. D., LL. D.... ....100 Twentieth street
Professor of Geology

JOSIAH RENICK SMITH, M. A............. .....332 East State street
Professor of Greek

BENJAMIN FRANKLIN THOMAS, Ph. D.......... University Grounds
Professor of Physics

GEORGE WELLS KNIGHT, Ph. D............. .... University Grounds
Professor of History and Political Science

ROSSER DANIEL BOHANNAN, B. Sc., C. E., E. M.............
....16th and Indianola avenues
Professor of Mathematics

C. NEWTON BROWN, C. E......................1343 Forsythe avenue
Professor of Civil Engineering

ERNST AUGUST EGGERS.........................University Grounds
Professor of the German Language and Literature

BENJAMIN LESTER BOWEN, Ph. D..............46 Jefferson avenue
Professor of the Romance Languages and Literatures

JOSEPH VILLIERS DENNEY, B. A........... ......The Richelieu
Professor of Rhetoric and the English Language

ARTHUR LYMAN WILLISTON, Sc. B., Secretary..652 Franklin ave.
Director of the Industrial Department

EDWARD ORTON, Jr., E. M.... ....36 North Monroe avenue
Director of the Department of Clay-Working and Ceramics

JOHN THOMAS MARTIN, 1st Lieut., 5th Artillery, U. S. A ....
....1194 Fair avenue
Professor of Military Science and Tactics and Assistant in Mathematics

WILLIAM T. MAGRUDER, M. E.
Professor of Mechanical Engineering

JOSEPH NELSON BRADFORD, M. E............54 West Tenth avenue
Associate Professor of Drawing

WILLIAM McPHERSON, Jr., D. Sc..... ....The Normandie
Associate Professor of General Chemistry

HENRY CURWEN LORD, B. Sc. ....186 West Ninth avenue
Director of the Emerson McMillin Observatory and Associate Professor of Astronomy

FRANK ARNOLD RAY, E. M....... ....76 Lexington avenue
Associate Professor of Mining Engineering

GEORGE WASHINGTON McCOARD, M. A.......319 West Fifth avenue
Assistant Professor of Mathematics

EMBURY ASBURY HITCHCOCK, M. E.........54 West Tenth avenue
Assistant Professor of Experimental Engineering

FRANCIS CARY CALDWELL, B. A., M. E.....100 West Eighth avenue
Assistant Professor of Electrical Engineering

*CHARLES WALTER MESLOH, M. A.
Assistant Professor of German

*JOSEPH RUSSELL TAYLOR, B. A.
Assistant in Rhetoric

CHARLES LINCOLN ARNOLD, M. Sc..........239 West Tenth avenue
Assistant in Mathematics

CHARLES WILLIAM WEICK....................30 East Ninth avenue
Assistant in the Industrial Department and Foreman of the Carpenter and Pattern Shops

WILLIAM ABNER KNIGHT.....................206 West Lane avenue
Assistant in the Industrial Department and Foreman of the Machine Shops

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Assistant in the Industrial Department and Foreman of the Forge Room

THOMAS EWING FRENCH, M. E..............1458 Worthington street
Assistant in Drawing

KARL DALE SWARTZEL, M. Sc..............57 West Frambes avenue
Assistant in Mathematics

CHARLES A. BRUCE, B. A....................234 West Tenth avenue
Assistant in French

JOHN ADAMS BOWNOCKER, B. Sc..................1594 Neil avenue
Assistant in Geology

ROMEO ORPHEUS KEISER, B. Sc....................122 King avenue
Laboratory Assistant in General Chemistry

WILLIAM LUCIUS GRAVES, B. A................878 Dennison avenue
Assistant in Rhetoric and the English Language

BERTHOLD AUGUST EISENLOHR.
Assistant in German

—— —— ——
Fellow, and Laboratory Assistant in Electrical Engineering.

FRANK HAAS, C. E...............................233 Eleventh avenue
Fellow, and Laboratory Assistant in Mining and Metallurgy

WILLIAM LLOYD EVANS, B. Sc..................189 Jefferson avenue
Fellow, and Laboratory Assistant in General Chemistry

RAYMOND MOLLYNEAUX HUGHES, A. B..........135 King avenue
Fellow, and Laboratory Assistant in General Chemistry

FREDERICK EDWARD KESTER, M. E..............1473 Neil avenue
Fellow, and Laboratory Assistant in Physics

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Fellow in Rhetoric and English Language, and Manuscript Reader

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*Absent on leave.

OHIO STATE UNIVERSITY

THE STATE SYSTEM OF EDUCATION

A State system of free, public education, worthy of the name, freely offers every opportunity and inducement to its entire school population to pass by systematic methods, easily apprehended by those who are to receive the benefits, in schools under popular control, from the lowest seat in a primary school to graduation by a University of high standing. It is not supposed that all pupils can or will accept these opportunities or respond to these inducements. But the highest welfare of the State demands that both opportunity and inducement should be continually present, and that the broad and firm highway of sound training and of higher learning should be opened freely to every child of the State.

This State system is naturally divided into three great sections. The first includes the rural or district schools, and the work done in the first eight grades of the city schools. To this is generally given the name of "the Grades." The second division includes the High Schools. The work of the third division is done by the University.

THE UNIVERSITY

This means that the University is practically the thirteenth, fourteenth, fifteenth and sixteenth grades of this State system of free public education. Its work is related to that of the High Schools precisely as their work is related to that of "the Grades." It ought to be quite as natural for a pupil to look forward from the High School to work in the University, as to look forward from "the Grades" or the Rural Schools to work in the High Schools.

THE COLLEGES

The Ohio State University is divided into six colleges, as follows:

The College of Agriculture and Domestic Science consists of those departments represented in the courses leading to the degrees of Bachelor of Science in Agriculture, Bachelor of Science in Horticulture and Forestry, and Bachelor of Science in Domestic Science; in the Short Course in Agriculture, in the Short Course in Domestic Science, and in the Course in Dairying.

The College of Arts, Philosophy and Science consists of those departments represented in the courses leading to the degrees of Bachelor of Arts, Bachelor of Philosophy, and Bachelor of Science; and in the Courses Preparatory to Law and Journalism, and to Medicine.

The College of Engineering consists of those departments represented in the courses leading to the degrees of Civil Engineer, Engineer of Mines, Engineer of Mines in Ceramics, Mechanical Engineer, Mechanical Engineer in Electrical Engineering, and Bachelor of Science in Industrial Arts; in the Course in Architecture, in the Short Course in Mining, in the Short Course in Industrial Arts, and in the Short Course in Clay-working and Ceramics.

The College of Law consists of the departments represented in the course leading to the degree of Bachelor of Laws.

The College of Pharmacy consists of those departments represented in the courses leading to the degree of Bachelor of Science in Pharmacy, and in the Short Course in Pharmacy.

The College of Veterinary Medicine consists of those departments represented in the course leading to the degree of Doctor of Veterinary Medicine, and to a certificate of Veterinary Surgeon.

Each College is under the direction of its own Faculty, which has power to act in all matters pertaining to the work of students in that College.

ADMISSION TO THE COLLEGES

The University is open on equal terms to both sexes.

The entrance examinations for 1896 will be held on Monday and Tuesday, June 15 and 16, and on Monday and Tuesday, September 14 and 15. A part of the examinations may be taken in June and the remainder in September. Conditions incurred at the June examinations must be removed at the September examinations.

Applicants for admission to the Colleges of Agriculture, of Arts, Philosophy and Science, or of Pharmacy, must be at least sixteen years of age; for admission to the College of Engineering or of Veterinary Medicine must be at least seventeen years of age; for admission to the College of Law must be at least eighteen years of age. Each must be provided with credentials of scholarship from his last instructor or from the last institution with which he has been connected, and with a certificate of good moral character.

There are three modes of admission to the University:

1. Certificates of Colleges and Normal schools in Ohio are accepted, if found satisfactory, in lieu of examination for preparatory studies and for advanced standing under the following conditions:

Each certificate must show that the applicant has completed the course of study in the school from which he comes, and must further contain a detailed statement of the studies pursued, the text books used, the amount of work done in each study, the amount of time devoted to it, the date of the examination, and the applicant's rank or standing in it. A copy of the course of study should accompany the certificate; and both should be sent to the University not later than the first of September.

Applicants for admission who come from other Colleges or Universities are required to bring certificates of honorable dismission.

Teachers' certificates (in force) will be accepted at their face value.

2. From time to time the Faculty approves the courses of study in certain High Schools of the State; and the graduates of these High Schools are admitted on presentation of cards issued to them at their graduation by the University through the Principals of the High Schools.

3. All other applicants are subject to examination on the groups of studies mentioned under the headings of those Colleges and Courses in the University which they desire to enter.

Full equivalents for the text-books named will be accepted.

FOR ADMISSION TO THE FOUR-YEAR COURSES, AND TO THE COURSE IN ARCHITECTURE: COLLEGE OF ENGINEERING[1]

The following are the requirements:

1. *Arithmetic, Descriptive and Physical Geography, English Grammar, and United States History.*

2. *English* — (*a*) Composition and Rhetoric. Each applicant will be tested as to his ability to write clear and correct English. The test will be the writing of two essays of about two hundred words each. The first essay will be upon a subject drawn from the candidate's observation or experience; as "A description of my native town," "The most remarkable person I ever met," "My reasons for seeking a University education." The second essay will be upon a subject drawn from a list of classics which will be furnished on application.

The proper preparation for this requirement is sustained and regular practice in writing. The pupil should be afforded weekly practice in preparing written exercises — paragraphs, outlines, themes, reproductions and abstracts; and his written work should be corrected by the teacher and revised and rewritten by himself.

The pupil should be familiarized with those principles of Rhetoric which are most likely to help him in his composition work; such as the principles of sentential structure, outlining, paragraphing, and choice of words. The study of specimens of bad English is not recommended; the time usually devoted to this may be better spent in memorizing and reciting notable passages of prose and poetry selected from works read entire by the class. Exercises in speaking from a topical outline previously prepared by the class are recommended for drill in expression and choice of words.

The subjects for the weekly written exercises should be so distributed that the pupil will have practice in the four types — description, narration, exposition and argumentation. Some of these subjects should be taken from the classics prescribed below and from other classics, preferably by the same authors, prescribed for parallel or subsidiary outside reading by the class; but fully one-half of the subjects upon which the pupil writes during his preparatory course should be drawn from his own observation and experience, especially subjects in description and narration.

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[1] An applicant for admission who may be somewhat in arrears in any given subject, will find opportunity to make up this work in the Columbus High School, which is fully accredited by the University.

(*b*) English Classics — Questions will be set for the purpose of testing the applicant's knowledge of the subject-matter, form and substance, of the following books; with the plot, purpose, literary style and peculiarities, incidents, and characters of which the applicant should make himself thoroughly familiar.

1896. Shakespeare's *A Midsummer Night's Dream*, or *The Merchant of Venice;* Scott's *Woodstock;* Longfellow's *Evangeline;* George Eliot's *Silas Marner;* Irving's *Tales of a Traveler.*

1897. Shakespeare's *As You Like It*, or *The Merchant of Venice;* Scott's *Marmion;* Longfellow's *Evangeline*; George Eliot's *Silas Marner;* Irving's *Tales of a Traveler.*

1898. Milton's *Paradise Lost*, Books I and II; Pope's *Iliad*, Books I and XXII; Goldsmith's *The Vicar of Wakefield;* Southey's *Life of Nelson*; Lowell's *The Vision of Sir Launfal;* Hawthorne's *The House of the Seven Gables.*

These or equivalent texts will require minute and critical study in class during at least one school year. The test here is the pupil's ability to analyze plot and character, to explain words, phrases and figures, to reproduce thought, to point out characteristics of style. Systematic class-room study of the texts themselves is the only adequate preparation. Literary history, literary biography and the comments of professional critics will not serve the purpose. The work in class should be intensive and disciplinary; there the distinction between the reading of literature and the study of classics should be sharply defined. Outside reading of other works, preferably by the same authors, is recommended, and should be prescribed as the basis of part of the composition work; but this general reading and composition work should not be regarded as an adequate substitute for the minute study of the few classics prescribed above, and will not be accepted as preparation for this part of the English requirement.

3. *Algebra* —Wentworth's or Wells's Elements, complete.

4. *Civil Government* — Fiske or Thorpe preferred.

5. *Geometry, Plane and Solid* — Venable, Wentworth, or Wells.

6. *History* — Myers's *General History.*

7. *Latin* — Pronunciation (the Roman method(; Grammar (an exact knowledge of the inflections is essential); Cæsar, the first four books of the *De Bello Gallico.*

Or *French* — The whole subject of French Grammar. Applicants will be expected to read at sight easy French, and to translate correctly into French. simple English sentences. Two years ought to be given to this study, the first year being spent mainly on the Grammar and the second devoted to reading good modern French. The texts read should be chiefly narrative and conversational prose; modern, rather than classic, dramas should be read.

Or *German* — Joynes-Meissner's German Grammar, complete; Joynes's German Reader, complete; Hauff's *Liechtenstein*, Lessing's *Minna von Barnhelm*, Huss's *Sessenheim* and Buchheim's Goethe's *Dichtung und Wahrheit.*

For the present, the *German* or *French* required for admission may be begun at the University, but without University credits.

8. *Physics* — Gage, Carhart and Chute, Avery or Appleton, complete.

THE COLLEGE OF ENGINEERING

COURSE IN CIVIL ENGINEERING

NOTE — The figure in parenthesis following the name of each study indicates the number of that study in its department. A full description of department work follows this statement of Courses.

FIRST YEAR

FIRST TERM	Credit hours	SECOND TERM	Credit hours	THIRD TERM	Credit hours
Drawing (4) Freehand.	2. ✓	Drawing (4) Freehand.	2. ✓	Drawing (2) Lettering.	2. ✓
~~French~~ (1) or German (1)	5 4. ✓	French (1) or German (1)	5 4. ✓	~~French~~ (1) or German (1)	5 4. ✓
Gen. Chemistry (1) Inorganic.	5. ✓	Gen. Chemistry (1) Inorganic.	5. ✓	Metallurgy (1) Mineralogy.	3. ✓
Mathematics (7) Trigonometry.	5. ✓	Mathematics (8), (9) Trig. and Algebra.	2, 3. ✓	Mathematics (10) Plane Analytics.	5. ✓
Rhetoric (1) Paragraph Writing.	2. ✓	Rhetoric (2) Theme Writing.	2. ✓	Rhetoric (3) Prose Analysis.	2. ✓
Cadet Service.	✓	Cadet Service.	✓	Cadet Service.	✓

SECOND YEAR

FIRST TERM	Credit hours	SECOND TERM	Credit hours	THIRD TERM	Credit hours
Civil Engineering (1) Surveying.	6. ✓	Civil Engineering (4) C. E. Drawing.	4. ✓	Civil Engineering (2) Surveying.	6. ✓
Drawing (7) Projections.	3. ✓	Drawing (9) Descriptive Geometry.	5. ✓	Drawing (10) Shades, Shadows and Per.	3. ✓
Mathematics (11) Space Analy. and Calculus.	3.	Mathematics (12) Calculus.	5. ✓	Mathematics (13) Calculus.	5. ✓
Physics (3) Mechanics and Heat.	3. ✓	Physics (4) Electricity & Magnatism.	3. ✓	Physics (5) Light and Sound.	3. ✓
Cadet Service.		Cadet Service. ✓		Cadet Service. ✓	
		VOLUNTARY			
~~French~~ (3)	2. ✓	or German (3)	2. ✓	or ~~Rhetoric~~ (5)	2.
		Each for the year			

THIRD YEAR

FIRST TERM	Credit hours	SECOND TERM	Credit hours	THIRD TERM	Credit hours
Civil Engineering (3) Surveying.	4. ✓	Civil Engineering (5) C. E. Drawing.	3. ✓	Astronomy (1) Practical.	4. ✓
Geology (2) General.	5. ✓	Civil Engineering (6) Stereotomy.	4. ✓	Civil Engineering (7) Bridge Strains.	5.
Mathematics (15) Least Squares.	2. ✓	Geology (3) General.	5. ✓	Drawing (14) Photography.	2. ✓
Mech. Engineering (1) Mechanics.	5. ✓	Mech. Engineering (1) Mechanics.	5. ✓	Mech. Engineering (2) Strength of Materials.	5. ✓
Rhetoric (4) Advanced.	2. ✓	Rhetoric (4) Advanced.	2. ✓	Rhetoric (4) Advanced.	2. ✓

FOURTH YEAR

Astronomy (2) Practical.	4.
Civil Engineering (9) Bridge Designing.	5.
Civil Engineering (10) Masonry.	5.
Elec. Engineering (6) Laboratory.	3.
Civil Engin'g (11) or (12) Masonry, Railways.	5.
Civil Engineering (15) Testing Laboratory.	2.
Elec. Engineering (6) Laboratory.	3.
Geology (4) Economic.	5.
Mech. Engineering (11) Laboratory.	3.
Civil Engineering (13) Water Supply.	5.
Civil Engineering (14) Sanitary Engineering.	5.
Law of Contracts	5.

THESIS

As a requisite for graduation, each candidate must present an acceptable thesis, embodying the results of a special study. The subject of this study must lie within the field of Civil Engineering. The subject must be announced to the President of the University (dependent upon the approval of the head of the Department), not later than the beginning of the second term of the Senior Year, and the completed thesis must be submitted not later than the second Saturday before Commencement Day.

TIME SCHEDULE

COURSE IN CIVIL ENGINEERING

First Year — I. and II. Terms. (Common to all Engineering Courses).

Section A — Drawing (4), 1-3 p. m., M., W. French (1) or German (1), 11 a. m., T., W., Th., F. Gen. Chemistry (1), lecture, 11 a. m., M. (for all). Gen. Chemistry (1), Quiz, 3 p. m., F. Gen. Chemistry (1), Laboratory 1-4 p. m., T., Th. Mathematics (7), (8), (9), 10 a. m., daily. Rhetoric (1), (2), 3 p. m., M., W.

Section B — Drawing (4), 1-3 p. m., T., Th. French or German, Gen. Chemistry Lecture, and Mathematics as in A. Gen. Chemistry (1), Quiz, 2 p. m., F. Rhetoric (1), (2), 3 p. m., T., Th.

Section C — Drawing (4), 8-10 a. m., M., Tu. Gen. Chemistry (1), Laboratory 8-10 a. m., W., Th., F. Gen. Chemistry (1), Quiz, 2 p. m , M. Gen. Chemistry (1), Lecture 11 a. m., M. French or German, and Mathematics, as in A, or French (1) or German (1), 3 p. m., T., W., Th., F., and Mathematics (7), (8), (9), 1 p. m., daily. Rhetoric (1), (2), 2 p. m., W., F.

Section D — Drawing (4), 10-12 a. m., W., F. Gen. Chemistry (1), Lecture 11 a. m., M. Gen. Chemistry (1), Laboratory, 8-11 a. m., M., Tu. Gen. Chemistry (1), Quiz, 10 a. m., Th. French (1) or German (1), 3 p. m., T., W., T., F. Mathematics (7), (8), (9), 1 p. m., daily. Rhetoric (1), (2), 3 p. m., M., W.

Section E — Drawing (4), 8-10 A. M., W., Th. Gen. Chemistry (1), Laboratory, 8-11 A. M., F. and *Saturday*. Gen. Chemistry (1), Lecture 11 A. M., M. Gen. Chemistry (1), Quiz, 10 A. M., Tu. French (1) or German (1), as in C. Mathematics (7), (8), (9), 1 P. M., daily. Rhetoric (1), (2), 3 P. M., T., Th.

First Year — III. Term — Drawing (2), 8-10 A. M., M., W., F. French (1) or German (1), 11 A. M. or 3 P. M., T., W., Th., F. Mathematics (10), 1 P. M., daily. Metallurgy (1), 10 A. M., M., W., F. Rhetoric (3), 2 P. M., W., F., or 3 P. M., T., Th., or M., W.

Second Year — Civil Engineering (1), (4), (2), 1 P. M., daily. Drawing (7), (8), (10), Lecture 9 A. M., T., Th.; Practice, 10-12 A. M., T., Th. Mathematics (11), (12), (13), 8 A. M., daily. Physics (3), (4), (5), 9 A. M., M., W., F. For voluntary subjects, consult the Professors in charge.

Third Year — Astronomy (1), 11 A. M., T., W., Th., F. Civil Engineering (3), 1-4 P. M., daily. Civil Engineering (5), 10-12 A. M., T., Th., F. Civil Engineering (6), 1 P. M., T., W., Th., F. Civil Engineering (7), 9 A. M., daily. Drawing (14), 1-3 P. M., M., Tu, Geology (2), (3), 9 A. M., daily. Mechanical Engineering (1), (2), 8 A. M., or 11 A. M., daily, I. and II. terms; 8 A. M., daily, III. Term. Rhetoric (4), 10 A. M., M., W.

Fourth Year — Astronomy (2), 11 A. M., M., Th., F. and 1 P. M., Tu. Civil Engineering (9), 9 A. M., daily. Civil Engineering (11) or (12), 8 A. M., daily 1, III. term; 1 P. M., daily, II. term. Civil Engineering (13), 9 A. M., daily. Civil Engineering (14), 10 A. M., daily. Electrical Engineering (5), 10-12 A. M., Tu., W., with Lecture, 10 A. M., M. Electrical Engineering (6), 8-10 A. M., Tu., W.; Lecture 10 A. M., M. Geology (4), 2 P. M., daily. Mechanical Engineering (11), Lecture 8 A. M., Mon. with Laboratory, 9-11 A. M., Mon.; 8–10 A. M., F.; 2-4 P. M., F.

COURSE IN CLAY-WORKING AND CERAMICS

FIRST YEAR

First Term	Credit hours	Second Term	Credit hours	Third Term	Credit hours
Drawing (4) Freehand.	2.	Drawing (4) Freehand.	2.	Drawing (2) Lettering.	3.
Gen. Chemistry (1) Inorganic.	5.	Gen. Chemistry (1) Inorganic.	5.	Metallurgy (1) Mineralogy.	3.
German (1) Elementary.	4.	German (1) Elementary.	4.	German (1) Elementary.	4.
Mathematics (7) Trigonometry.	5.	Mathematics (8), (9) Trigonometry and Algebra.	2, 3.	Mathematics (10) Plane Analytics.	5.
Rhetoric (1) Paragraph Writing.	2.	Rhetoric (2) Theme Writing.	2.	Rhetoric (3) Prose Analysis.	2.
Cadet Service.		Cadet Service.		Cadet Service.	

SECOND YEAR

First Term	Credit Hours	Second Term	Credit Hours	Third Term	Credit Hours
Ceramics (1)	4.	Ceramics (2)	4.	Ceramics (3)	4.
		(Chemical Laboratory extending through the year).			
Drawing (7) Projections.	3.	Drawing (8) Descriptive Geometry.	3.	Drawing (10) Shades, Shadows and Per.	3.
Mathematics (11) Analytics and Calculus.	5.	Mathematics (12) Calculus.	5.	Mathematics (13) Calculus.	5.
Physics (3) Mechanics and Heat.	3.	Physics (4) Electricity and Magnetism.	3.	Physics (5) Light and Sound.	3.
Shopwork (A4) Woodwork.	2.	Shopwork (B3) Forging.	2.	Shopwork (D4) Chipping and Filing.	2.
Cadet Service.		Cadet Service.		Cadet Service.	

THIRD YEAR

Ceramics (4) General Principles.	5.	Ceramics (5) Bricks.	5.	Ceramics (6) Pottery.	5.
Mining Engin'g (4) Mine Surveying.	5.	Ceramics (7) Advanced Chemical Laboratory Work.	5.	Ceramics (8) Advanced Chemical Laboratory Work.	5.
Mech. Engineering (1) Analytic Mechanics.	5.	Mech. Engineering (1) Analytic Mechanics.	5.	Mech. Engineer'g (2) Strength of Materials.	5.
Rhetoric (4) Advanced.	2.	Rhetoric (4) Advanced.	2.	Rhetoric (4) Advanced.	2.

FOURTH YEAR

Ceramics (9) Manufacture of Bodies.	5.	Ceramics (10) Glasses and Glazes.	5.	Ceramics (11) Enamels and Colors.	5.
Drawing (14) Photography.	2.	Ceramics (12) Cement.	5.	Ceramics (14) Reports on Clay Prop.	5.
Geology (2) General.	5.	Ceramics (13) Ceramic Construction.	2.	Ceramics (15) Thesis Work.	5.
Metallurgy (3) Fuels and Iron.	5.	Geology (4) Economic.	5.		

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*A rule of the Board of Trustees requires each male student (except students in the College of Law) to render two years' cadet service as a condition of graduation. Students physically incapacitated for cadet service will be assigned an equivalent in special gymnasium work. The President has authority to excuse from cadet service, under certain conditions.

TIME SCHEDULE

COURSE IN CLAY-WORKING AND CERAMICS

First Year — Drawing (4), (2), 1-3 p. m., M. Gen. Chemistry (1), lecture 11 a. m., M.; Quiz. 3 p. m., F. Laboratory 1-4, T., Th. German (1), 11 a. m., Tu., W., Th., F. Mathematics (7), 10 a. m. or 1 p. m., daily. Mathematics (8), 10 a. m. or 1 p. m., T., Th. Mathematics (9), 10 a. m. or 1 p. m., M., W., F. Metallurgy (1), 10 a. m., M., W., F. Rhetoric (1), (2), (3), 10 a. m. or 1 p. m., T., Th.; 2 p. m., W., F.; 3 p. m., M., W. or T., Th.

Second Year — Ceramics (1), (2), 1-4 p. m., M., Tu., W. Drawing (7), (8), (10), lecture 9 a. m., T., Th. and practice 10-12 a. m., T., Th. Mathematics (11), (12), (13), 8 a. m., daily. Physics (3), (4), (5), 9 a. m., M., W., F. Shopwork (A4), (B3), (D4), 2-4 p. m., T., Th.

Third Year — Ceramics (4), (5), (6), 8-10 a. m., daily. Mechanical Engineering (1), (2), 11 a. m., daily. Mine Engineering (4), 2-4 p. m., daily. Rhetoric (4), 10 a. m., M., W.

Fourth Year — Ceramics (9), (10), (11), 10-12 a. m., daily. Drawing (14), 1-3 p. m., M., Tu. Metallurgy (3), 1 p. m., daily. Geology (2), 9 a. m., daily. Geology (4), 2 p. m., daily. Other courses in Ceramics at hours to suit the class.

COURSE IN ELECTRICAL ENGINEERING

FIRST YEAR

First Term	Credit hours	Second Term	Credit hours	Third Term	Credit hours
Drawing (4) Freehand.	2.	Drawing (4) Freehand.	2.	Drawing (2) Lettering.	3.
French (1) or German (1)	4.	French (1) or German (1)	4.	French (1) or German (1)	4.
Gen. Chemistry (1) Inorganic.	5.	Gen. Chemistry (1) Inorganic.	5.	Shopwork (F1) Carpentry and Forging.	2.
Mathematics (7) Trigonometry.	5.	Mathematics (8), (9) Trigonometry and Algebra.	2, 3.	Mathematics (10) Plane Analytics.	5.
Rhetoric (1) Paragraph Writing.	2.	Rhetoric (2) Theme Writing.	2.	Rhetoric (3) Prose Analysis.	2.
Cadet Service.		Cadet Service.		Cadet Service.	

SECOND YEAR

Drawing (7) Projections.	3.	Drawing (8) Descriptive Geometry.	3.	Drawing (10) Shades, Shadows & Per.	3.
Mathematics (11) Analytics and Calculus.	5.	Mathematics (12) Calculus.	5.	Mathematics (13) Calculus.	5.
Physics (3) Mechanics.	3.	Physics (4) Electricity, Magnetism.	3.	Physics (5) Light, Sound.	3.
Physics (6) Problems.	2.	Physics (6) Problems.	2.	Physics (6) Problems.	2.
		Physics (8) Laboratory.	3.	Physics (9) Laboratory.	3.
Rhetoric (4) Advanced.	2.	Rhetoric (4) Advanced.	2.	Rhetoric (4) Advanced.	2.
Shopwork (D3) Chipping and Filing.	2.				
Cadet Service.		Cadet Service.		Cadet Service.	

VOLUNTARY

French (3)	2.	or German (3) Each for the year.	2.	or Rhetoric (5)	2.

THIRD YEAR

First Term	Hours of Credit	Second Term	Hours of Credit	Third Term	Hours of Credit
Drawing (13) Technical.	3.	Shopwork (E6) Machinery.	4.	Mech. Engin'g (15) Technical Drawing.	5.
Mathematics (14) Differential Equations.	2.	Mech. Engin'g (4) Mechanism.	5.	Mech. Engin'g (13) Laboratory.	4.
Mech. Engin'g (1) Mechanics.	5.	Mech. Engin'g (1) Mechanics.	5.	Mech. Engin'g (2) Strength of Materials.	5.
Physics (10) Laboratory.	4.	Physics (11) Laboratory.	5.	Physics (12) Laboratory.	5.
Physics (7) Electricity and Magnetism.	3.				

FOURTH YEAR

Elec. Engin'g (1) Elec. Machinery.	5.	Elec. Engin'g (1) Elec. Machinery.	5.	Elec. Engin'g (2) Elec. Machinery.	3.
Elec. Engin'g (3) Designing and Drawing.	3.	Elec. Engin'g (3) Designing and Drawing.	3.	Elec. Engin'g (4) Designing and Drawing.	5.
Elec. Engin'g (5) Laboratory.	5.	Elec. Engin'g (5) Laboratory and Thesis.	5.	Elec. Engin'g (5) Laboratory and Thesis.	5.
Mech Engin'g (6) Thermodynamics.	5.	Mech. Engin'g (7) Prime Movers.	5.	Mech. Engin'g (8) Machinery.	5.

THESIS

As a requisite for graduation, each candidate must present an acceptable thesis, embodying the results of a special study. The subject of each study must lie within the field of Electrical Engineering. The subject must be announced to the President of the University (dependent upon the written approval of the head of the department) not later than the beginning of the second term of the Senior Year.

TIME SCHEDULE

COURSE IN ELECTRICAL ENGINEERING

First Year — I and II terms. Same as for Civil Engineers.

First Year — III term.

Section A — Drawing (2), 8-10 a. m., M.; 1-3 p. m. Th. French (1) or German (1), 11 a. m., T., W., Th., F. Mathematics (10), 10 a. m., daily. Rhetoric (3), 3 p. m., T., Th. Shopwork (F1), 1-4 p. m., M., W.

Section B — Drawing (2), 1-3 p. m., M., W., F. French (1), German (1). Mathematics (1), as in A. Rhetoric (3), M., W. Shopwork (F1), 8-10 a. m., W., F.; 1-4 p. m., T., Th.

Second Year — Drawing (7), (8), (10); Lecture, 9 a. m., T., Th.; Practice, 10-12 a. m., T., Th. Mathematics (11), (12), (13), 8 a. m., daily. Physics (3), (4), (5), 9 a. m., M., W., F. Physics (6), 10 a. m., W., F. Physics (8), (9); Laboratory, 1-4 p. m., Th. F. Rhetoric, 11 a. m., W., F. Shopwork (D3). 1-3 p. m., M., T.

Third Year — I and II terms — Drawing (3), 1-4 P. M., Th., F. Mechanical Engineering (1), 11 A. M., daily. Mechanical Engineering (4), 8 A. M., daily. Mathematics (14), 9 A. M., T., Th. Physics (7), 8 A. M., M., W., F. Physics (10), (11), 1-4 P. M., M., T., W. Shopwork (E6), 1-3 P. M., Th., F.

Third Year — III term — Mechanical Engineering (2), 1 P. M., daily. Physics (12), 2-4 P. M., daily.

Section A — Mechanical Engineering (13), 8-12 A. M., M., T. Mechanical Engineering (5), 8-12 A. M., W., Th.; 10-12 A. M., F.

Section B — Mechanical Engineering (13), 8-12 A. M., W., Th. Mechanical Engineering (15), 8-12 A. M., M., T.; 8-10 A. M., F.

Section C — Mechanical Engineering (13), 8-12 A. M., F., Sat. Mechanical Engineering (15). distributed with (A), (B).

Fourth Year — Electrical Engineering (6), 8-10 A. M., M., W., F. Electrical Engineering (7), 8-10 A. M., M., W., F. Industrial Arts (8), 9 A. M., T., Th. Mechanical Engineering (6). (7), (8), 1 P. M., daily. Mechanical Engineering (16), 10 A. M., daily. Mechanical Engineering (17), 8 A. M., T., Th. Mechanical Engineering (11), (12), (14), 2-4 P. M., daily.

COURSE IN INDUSTRIAL ARTS

FIRST YEAR

First Term	Credit hours	Second Term	Credit hours	Third Term.	Credit hours
Drawing (6) Freehand.	1.	Drawing (6) Freehand.	1.	Drawing (6) Freehand.	1.
Drawing (15) Geometric.	2.	Drawing (15) Projections.	2.	Drawing (15) Lettering.	2.
Mathematics (7) Plane Trigonometry.	5.	Mathematics (8, 9) Higher Trig. and Algebra.	2, 3.	Mathematics (10) Plane Analytics.	5.
Rhetoric (1) Paragraph Writing.	2.	Rhetoric (2) Theme Writiag.	2.	Rhetoric (3) Prose Analysis.	2.
Shop Work (A 1) Carpentry and Pattern Making.	3.	Shop Work (A 1) Carpentry and Pattern Making.	3.	Shop Work (A 1) Carpentry and Pattern Making.	3.
Cadet Service.		Cadet Service.		Cadet Service.	

Electives, three to five hours,— any work upon which the student is qualified to enter, in any College except the College of Law.

SECOND YEAR

First Term	Credit hours	Second Term	Credit hours	Third Term	Credit hours
Drawing (16) Mechanical.	3.	Drawing (16) Mechanical.	3.	Drawing (16) Mechanical.	3.
Physics (3) Mechanics and Heat.	3.	Physics (4) Electricity.	3.	Physics (5) Sound and Light.	3.
Rhetoric (4) Advanced.	2.	Rhetoric (4) Advanced.	2.	Rhetoric (4) Advanced.	2.
Shop Work (B 1) Forging.	3.	Shop Work (B 1) Forging.	3.	Shop Work (D 1) Chipping and Filing.	3.
Cadet Service.		Cadet Service.		Cadet Service.	

Elective, six to eight hours,—any work upon which the student is qualified to enter, in any College except the College of Law.

THIRD YEAR

First Term	Credit hours	Second Term	Credit hours	Third Term	Credit hours
Drawing (13) Technical.	3.	Industrial Arts (4) Tech. Drawing.	3.	Industrial Arts (5) Tech. Drawing.	3.
Industrial Arts (3) Hand and Machine Tools.	3.	Industrial Arts (3) Hand and Machine Tools.	4.	Industrial Arts (5) Hand and Machine Tools.	3.
Shop Work (E 1) Machine Work.	3.	Shop Work (E 1) Machine Work.	3.	Shop Work (E 1) Machine Work.	3.

Electives, eight to ten hours,—any work upon which the student is qualified to enter, in any College except the College of Law.

FOURTH YEAR

Industrial Arts (6) Shop Equipment.	3.	Industrial Arts (6) Shop Appliances.	3.	Industrial Arts (6) Shop Management.	3.
Industrial Arts (7) Tech. Drawing.	3.	Industrial Arts (7) Tech. Drawing.	3.	Industrial Arts (7) Tech. Drawing.	3.
Shopwork (E 5) Machine Work.	3.	Shopwork (E 5) Machine Work.	3.	Shopwork (E 5) Machine Work.	3.

Electives, eight to ten hours,—any work upon which the student is qualified to enter, in any College, except the College of Law. Among the electives, the student must choose History (5) or (6), and Economics (1) or (2) [College of Arts], together making four hours a week through the year. At some time during the Course, the student must elect in Chemistry the equivalent of at least five hours for two terms.

TIME SCHEDULE

COURSE IN INDUSTRIAL ARTS

REQUIRED WORK

First Year — Drawing (6), 10-12 A. M., M. Drawing (15), 2-4 P. M., M., T. Mathematics (7), (8), (9), (10), 10 A. M., or 1 P. M., daily. Rhetoric (1), (2), (3), 10 A. M., M., T., Th.; 2 P. M., W., F.; 3 P. M., M., W-, or T., Th.

Second Year — Drawing (16), 2-4 P. M., M., T., W. Physics (3), (4), (5), 9 A. M., M., W., F. Rhetoric, (4), 10 A. M., M., W., or 11 A. M. W., F. Shopwork (B), (D), 1-4 P. M., Th., F.

ELECTIVE WORK

For elective work, see also bulletins of other Colleges.

COURSE IN MECHANICAL ENGINEERING

FIRST YEAR

FIRST TERM	Credit hours	SECOND TERM	Credit hours	THIRD TERM	Credit hours
Drawing (4) Freehand.	2.	Drawing (4) Freehand.	2.	Drawing (2) Lettering.	3.
French (1) or German (1)	4.	French (1) or German (1)	4.	French (1) or German (1)	4.
Gen. Chemistry (1) Inorganic.	5.	Gen. Chemistry (1) Inorganic,	5.	Shopwork (A 3) Carpentry.	4.
Mathematics (7) Trigonometry.	5.	Mathematics (8), (9) Trigonometry & Algebra.	2, 3.	Mathematics (10) Plane Analytics.	5.
Rhetoric (1) Paragraph Writing.	2.	Rhetoric (2) Theme Writing.	2.	Rhetoric (3) Prose Analysis.	2.
Cadet Service.		Cadet Service.		Cadet Service.	

SECOND YEAR

Drawing (7) Projections.	3.	Drawing (8) Des. Geometry.	3.	Drawing (10) Shades, Shadows & Per.	3.
Mathematics (11) Analytics & Calculus.	5.	Mathematics (12) Calculus.	5.	Mathematics (13) Calculus.	5.
Physics (3) Mechanics & Heat.	3.	Physics (4) Electricity and Magnetism.	3.	Physics (5) Sound & Light.	3.
		Physics (13) Laboratory.	2.	Physics (14) Laboratory.	3.
Rhetoric (4) Advanced.	2.	Rhetoric (4) Advanced.	2.	Rhetoric (4) Advanced.	2.
Shopwork (B 5) Forging.	5.	Shopwork (D 2) Chipping.	3.	Shopwork (H 1) Foundry.	3.
Cadet Service.		Cadet Service.		Cadet Service.	

VOLUNTARY

French (3)	2.	or German (3)	2.	or Rhetoric (5)	2.

Each for the year.

THIRD YEAR

Drawing (13) Technical.	3.	Mec. Engineering (1) Mechanics.	5.	Drawing (14) Photography.	2.
Mathematics (14) Differential Equations.	2.	Mec. Engineering (3) Timber and Masonry.	3.	Civil Engineering (8) Bridge Strains.	5.
Mec. Engineering (1) Mechanics.	5.	Mec. Engineering (4) Mechanism.	5.	Mec. Engineering (2) Strength of Materials.	5.
Metallurgy (3) Useful Metals.	5.	Metallurgy (4) Useful Metals.	2.	Mec. Engineering (15) Technical Drawing.	5.
Shopwork (E 2) Machinery.	3.	Shopwork (E 3) Machinery.	4.	Mec. Engineering (5) Mechanism.	2.

FOURTH YEAR

FIRST TERM	Hours of Credit	SECOND TERM	Hours of Credit	THIRD TERM	Hours of Credit
Elec. Engineering (6) Laboratory.	3.	Elec. Engineering (6) Laboratory.	3.	Elec. Engineering (7) Laboratory.	3.
Mec. Engineering (14) Laboratory.	5.	Industrial Arts (8) Shop Appliances.	2.	Mec. Engineering (8) Machinery.	5.
Mec. Engineering (6) Thermodynamics.	5.	Mec. Engineering (7) Prime Movers.	5.	Mec. Engineering (12) Laboratory.	3.
		Mec. Engineering (11) Laboratory.	3.	Mec. Engineering (17) Hydraulic Mach.	2.
Mec. Engineering (16) Mach. Design,	5.	Mec. Engineering (16) Mach. Design.	5.	Mec. Engineering (18) Thesis Work.	5.

THESIS

As a requisite for graduation, each candidate must present an acceptable thesis embodying the results of a special study. The subject of each study must lie within the field of Mechanical Engineering. The subject must be announced to the President of the University (dependent upon the written approval of the head of the department) not later than the beginning of the second term of the Senior Year, and the completed thesis must be submitted not later than the second Saturday before Commencement Day.

TIME SCHEDULE

COURSE IN MECHANICAL ENGINEERING

FIRST YEAR — I and II terms. Same as for Civil Engineers.

FIRST YEAR — III term — Drawing (2), 8-10 A. M., M., W., F. Mathematics (10), 10 A. M., or 1 P. M. daily. French (1), or German (1), 11 A. M., T., W., T., F. Rhetoric (3), 3 P. M., T., Th. Shopwork (A3), 8-10 A. M., T., Th., 2-4 P. M.. M., W.

SECOND YEAR — Drawing (7), (8), (10). Lecture, 9 A. M., T., Th. Practice 10-12 A. M., T., Th. Mathematics (11), (12), (13), 8 A. M., daily. Physics (3), (4), (5), 9 A. M., M. W., F. Physics (13), 1-3 P. M., Th., F. Physics (14), 1-4 P. M., Th., F. Rhetoric (4), 11 A. M., W., F.

THIRD YEAR — Drawing (13), 2-4 P. M., W., Th., F. Drawing (14), 1-3 P. M., M., Tu. Civil Engineering (8), 9 A. M. or 1 P. M. daily. Mathematics (14), 11 A. M., T., Th. Mechanical Engineering (1), 8 A. M., daily first term, 1 P. M., daily second term. Mechanical Engineering (4), 8 A. M., daily. Mechanical Engineering (3), 10 A. M., M., W., F. Mechanical Engineering, (5), 8 A. M., T., Th. Mechanical Engineering (15), 10-12 A. M., daily, or 2-4 P. M., daily. Metallurgy (3), 1 P. M., daily, and Metallurgy (4), 1 P. M. daily for two-fifths of 2d term. Shopwork (E3), 2-4 P. M., M., T., W., Th.

Fourth Year — Electrical Engineering (6), (7); Lecture, 8 A. M, Th.; Practice, 10-12 A. M., Th., F. Industrial Arts (8), 9 A. M., T., Th. Mechanical Engineering (8), (9), (10), 1 P. M., daily. Mechanical Engineering (14), 10-12 A. M., M., T., W., 2-4 P. M., M., T. Mechanical Engineering (16), 8 A. M. daily, first term. Mechanical Engineering (11), 2-4 P. M., W., Th., F. Mechanical Engineering (12), 2-4 P. M., W., Th., F. Mechanical Engineering (17), 8 A. M., T., Th.

COURSE IN MINING ENGINEERING

FIRST YEAR

First Term	Credit hours	Second Term	Credit hours	Third Term	Credit hours
Drawing (4) Freehand.	2.	Drawing (4) Freehand.	2.	Drawing (2) Lettering.	3.
French (1) or German (1)	4.	French (1) or German (1)	4.	French (1) or German (1)	4.
General Chemistry (1) Inorganic.	5.	General Chemistry (1) Inorganic.	5.	Metallurgy (1) Mineralogy.	3.
Mathematics (7) Trigonometry.	5.	Mathematics (8) (9) Trigonometry & Algebra.	2, 3.	Mathematics (10) Plane Analytics.	5.
Rhetoric (1) Paragraph Writing.	2.	Rhetoric (2) Theme Writing.	2.	Rhetoric (3) Prose Analysis.	2.
Cadet Service.		Cadet Service.		Cadet Service.	

SECOND YEAR

First Term	Credit hours	Second Term	Credit hours	Third Term	Credit hours
Drawing (7) Projections.	3.	Drawing (8) Descriptive Geometry.	3.	Drawing (10) Shades, Shadows & Per.	3.
Mathematics (11) Analytics & Calculus.	5.	Mathematics (12) Calculus.	5.	Mathematics (13) Calculus.	5.
Metallurgy (2) Laboratory.	5.	Metallurgy (2) Laboratory.	5.	Metallurgy (2) Laboratory.	5.
Physics (3) Mechanics & Heat.	3.	Physics (4) Electricity and Magnetism.	3.	Physics (5) Light and Sound.	3.
Cadet Service.		Cadet Service.		Cadet Service.	
		VOLUNTARY			
French (3)	2.	or German (3) Each for the year.	2.	or Rhetoric (5)	2.

THIRD YEAR

First Term	Credit hours	Second Term	Credit hours	Third Term	Credit hours
Mechanical Engin'g (1) Mechanics.	5.	Mechanical Engin'g (1) Mechanics.	5.	Mechan'l Engin'g (2) Strength of Materials.	5.
Metallurgy (3) Useful Metals.	5.	Metallurgy (5) Useful Metals.	5.	Civil Engineering (8) Bridge Strains.	5.
Mine Engineering (1) Mine Surveying.	5.	Metallurgy (6) Assaying.	5.	Metallurgy (7) Deter. Mineralogy.	5.
Rhetoric (4) Advanced.	2.	Rhetoric (4) Advanced.	2.	Rhetoric (4) Advanced.	2.

FOURTH YEAR

First Term.	Hours of Credit.	Second Term.	Hours of Credit.	Third Term.	Hours of Credit.
Elec. Engin'g (6) Laboratory.	3.	Elec. Engin'g (6) Laboratory.	3.	Elec. Engin'g (7) Laboratory.	3.
Geology (2) General.	5.	Geology (3) General.	5.	Metallurgy (10) Plans and Specifications.	5.
Metallurgy (8) Metal Construction.	3.	Geology (4) Economic.	5.	Mine Engin'g (5) Mining Engin'g.	5.
Mine Engin'g (5) Mining Engin'g.	5.	Mine Engin'g (5) Mining Engin'g.	5.	Drawing (14) Photography.	2.
Metallurgy (9) Ore Dressing.	2.				

THESIS

As a requisite for graduation, each candidate must present an acceptable thesis, embodying the results of a special study. The subject of the study must lie within the field of Metallurgy or of Mining Engineering. The subject must be announced to the President of the University (dependent upon the written approval of the head of the department) not later than the beginning of the second term of the Senior Year, and the completed thesis must be submitted not later than the second Saturday before Commencement Day.

TIME SCHEDULE

COURSE IN MINING ENGINEERING

FIRST YEAR — Same as for Civil Engineers.

SECOND YEAR — Drawing (7), (8), (10), Lecture 9 A. M., T., Th.; Practice, 10-12 A. M., T., Th. Mathematics (11), (12), (13), 8 A. M., daily. Metallurgy (2), 2-4 P. M., daily. Physics (3), (4), (5), 9 A. M., M., W., F. For voluntary subjects, consult the professors in charge.

THIRD YEAR — Civil Engineering (8), 1 P. M., daily. Mechanical Engineering (1), (2), 11 A. M., daily. Metallurgy (4), (5), 1 P. M., daily. Metallurgy (6), 8-10 A. M., daily. Metallurgy (7); 8-10, A. M. daily. Rhetoric (4), 10 A. M., M., W.

FOURTH YEAR — Drawing (14), 2-4 P. M., M., T. Electrical Engineering (6), (7), 10-12 A. M., Th., F.; Lecture, 8 A. M., Th. Geology (2), (3), 9 A. M., daily. Geology (4), 2 P. M., daily. Metallurgy (8), 10 A. M., M., T., W. Metallurgy (9), 11 A. M., M., Tu. Metallurgy (10), 11 A. M., daily. Mine Engineering (5), 1 P. M , daily.

COURSE IN ARCHITECTURE

(TBREE YEARS.)

FIRST YEAR

FIRST TERM	Credit hours	SECOND TRRM	Credit hours	THIRD TERM	Credit hours
Drawing (5) Freehand.	3.	Drawing (5) Freehand.	5.	Drawing (5) Freehand.	3.
Gen. Chemistry (1) Inorganic.	5.	Gen. Chemistry (1) Inorganic.	5.	Drawing (2) Lettering.	3.
Mathematics (7) Plane Trigonometry,	5.	Mathematics (8, 9) Trigonometry, Algebra.	2, 3.	Mathematics (10) Plane Analytics.	5.
Rhetoric (1) Paragraph Writing.	2.	Rhetoric (2) Theme Writing.	2.	Rhetoric (3) Prose Analysis.	2.
Shopwork (A 4) Carpentry and Pattern Making.	2.	Shopwork (E 8) Machine Work.	3.	Shopwork (B 4) Forging.	3.
Cadet Service.		Cadet Service.		Cadet Service.	

SECOND YEAR

Drawing (14) Photography.	2.	Architecture (1) Orders.	5.	Architecture (2) Styles.	5.
Drawing (7) Projections.	3.	Drawing (9) Descriptive Geometry.	5.	Drawing (11) Shades, Shadows and Perspective.	5.
Drawing (20) Pen.	2.	Drawing (21) Clay Modelling.	2.	Drawing (21) Clay Modelling.	2.
Greek (9) Ancient Art.	2.	Greek (9, 10) Ancient Art.	2.	Greek (10) Ancient Art.	2.
Physics (3) Mechanics and Heat.	3.	Physics (4) Electricity and Magnetism.	3.	Physics (5) Light and Sound.	3.
Mechanical Eng. (19) Materials of Construction.	5.				
Cadet Service.		Cadet Service.		Cadet Service.	

THIRD YEAR

Architecture (3) Designing.	5.	Architecture (3) Designing.	5.	Architecture (3) Designing.	5.
Architecture (4) Specifications.	2.	Architecture (5) Decorations.	3.	Architecture (6) Estimates.	4.
Civil Engineering (10) Masonry.	5.	Architecture (7) Heating.	5.	Architecture (8) Designing.	5.
Civil Engineering (16) Roof Trusses.	5.	Civil Engineering (6) Stereotomy.	4.	Civil Engineering (17) Surveying.	3.

TIME SCHEDULE

COURSE IN ARCHITECTURE

First Year — Drawing (5), 1-10 A. M., M., T., W. General Chemistry (1), Lecture 11 A. M., M. : (for quiz and laboratory hours, consult the professor). Mathematics (7), (8), (9), (10), 10 A. M., or 1 P. M., daily. Rhetoric (1), (2), (3), 10 A. M., T., Th.; 2 P. M., W. F.; 3 P. M., M., W., or T., Th. Shopwork (A4), 8-10 A. M., Th., F. Shopwork (E8), 8-10 A. M., Th., F.; 2-4 P. M., M. Shopwork (B4), 1-4 P. M., Th., F.

THE SHORT COURSES

The University authorities offer these courses for the benefit of those who for any reason are not able to carry the regular work of the Colleges. Persons of mature years, and some others, who simply desire to increase their earning power or their chances of promotion, and have neither the time nor the means for thorough education and broad culture, have certain claims on the University which it is not at all inclined to neglect or deny. But these Short Courses are not to be compared in breadth, strength, or thoroughness with the full courses of the University. They are intended to be helpful to those who need this kind of assistance, or who are so unfortunately situated that they can accept no other. They are far better preparation for the work to which they lead than no preparation; but they must not be considered as substitutes for regular work with full time.

ADMISSION TO THE SHORT COURSE IN CLAY-WORKING AND CERAMICS, IN INDUSTRIAL ARTS, AND IN MINING

Applicants must be not less than sixteen years of age, and unless they are over twenty-one years of age must pass an examination in *Arithmetic*, *Geography*, *Grammar* and *Orthography*, or bring High School or other certificates for these branches.

SHORT COURSE IN CLAY-WORKING AND CERAMICS

FIRST YEAR

First Term	Credit hours	Second Term	Credit hours	Third Term	Credit hours
Gen. Chemistry (1) Inorganic.	5.	Gen. Chemistry (1) Inorganic.	5.	Gen. Chemistry (2) Analytical.	5.
Physics (1) Elementary.	5.	Physics (2) Elementary.	5.	Geology (1) Phys. Geography.	5.
Mathematics (1) Algebra.	5.	Mathematics (2) Geometry.	5.	Shopwork (B4) Forging.	3.
				Shopwork (D4) Chipping and Filing.	2.
Cadet Service.		Cadet Service.		Cadet Service.	

SECOND YEAR

First Term	Hours of Credit	Second Term	Hours of Credit		Hours of Credit
Ceramics (1) Analysis of Limestones.	4.	Ceramics (2) Analysis of Clays.	4.	Ceramics (3) Analysis of Clays.	4.
Ceramics (4) Gen. Principles.	5.	Ceramics (5) Brick.	5.	Ceramics (6) Pottery.	5.
Geology (2) General.	5.	Geology (4) Economic.	5.	Drawing (17) Mechanical.	5.
Cadet Service.		Cadet Service.		Cadet Service.	

TIME SCHEDULE

SHORT COURSE IN CLAY-WORKING AND CERAMICS

First Year — General Chemistry (1), Lecture 11 A. M., M.: (for quiz and laboratory hours, consult the professor). General Chemistry (2), 1-4 P. M., M., Tu., W. Mathematics (6), 9 A. M., daily. Physics (1), (2), 8 A. M. or 10 A. M., daily. Geology (1), 8 A. M., daily. Shopwork (B4), 1-4 P. M., Th., F. Shopwork (D4), 10-12 A. M., T., Th.

Second Year — Ceramics (1), (2), (3), 1-4 P. M., M., Tu., W. Ceramics (4), (5), (6), 8-10 A. M., daily. Drawing (17). Geology (2), 9 A. M., daily. Geology (4), 2 P. M., daily.

SHORT COURSE IN INDUSTRIAL ARTS

FIRST YEAR

First Term	Credit hours	Second Term	Credit hours	Third Term	Credit hours
Drawing (6) Freehand.	1.	Drawing (6) Freehand.	1.	Drawing (6) Freehand.	1.
Drawing (15) Geometric.	2.	Drawing (15) Projections.	2.	Drawing (15) Lettering.	2.
Mathematics (6) Algebra.	5.	Mathematics (6) Algebra.	5.	Mathematics (6) Algebra.	5.
Mathematics (3) Plane Geometry.	5.	Mathematics (4) Space Geometry.	5.	Mathematics (5) Trigonometry.	5.
Shopwork (A2) Carpentry and Pattern Making.	3.	Shopwork (A2) Carpentry and Pattern Making.	3.	Shopwork (B4) Forging.	3.
Cadet Service.		Cadet Service.		Cadet Service.	

SECOND YEAR

Drawing (16) Mechanical.	3.	Drawing (16) Mechanical.	3.	Drawing (16) Mechanical.	3.
Industrial Arts (3) Hand and Machine Tools.	3.	Industrial Arts (3) Hand and Machine Tools.	3.	Industrial Arts (3) Hand and Machine Tools.	3.
Physics (1) Elementary.	5.	Physics (2) Elementary.	5.	Geology (1) Phys. Geography.	5.
Shopwork (D5) Chipping and Filing.	5.	Shopwork (E4) Machine Work.	5.	Shopwork (E7) Machine Work.	5.
Cadet Service.		Cadet Service,		Cadet Service.	

TIME SCHEDULE

SHORT COURSE IN INDUSTRIAL ARTS

FIRST YEAR — Drawing (6), 10-12 A. M., M. Drawing (12), 2-4 P. M., M., Tu. Mathematics (6), 9 A. M., daily. Mathematics (3), (4), (5), 11 A. M., daily. Shopwork (A2), 1-4 P. M., Th., F. Shopwork (B4), 1-4 P. M., Th., F.

SHORT COURSE IN MINING

FIRST YEAR

FIRST TERM	Credit hours	SECOND TERM	Credit hours	THIRD TERM	Credit hours
Mathematics (6) Algebra.	5.	Mathematics (6) Algebra.	5.	Mathematics (6) Algebra.	5.
Mathematics (3) Geometry.	5.	Mathematics (4) Geometry.	5.	Mathematics (5) Trigonometry.	5.
Physics (1) Elementary.	5.	Physics (2) Elementary.	5.	Geology (1) Phys. Geography.	5.
Cadet Service.		Cadet Service.		Cadet Service.	

SECOND YEAR

Drawing (3) Freehand.	2.	Drawing (12) Draughting.	3.	Drawing (2) Lettering.	3.
Drawing (7) Projections.	3.	Geology (5) Elementary.	5.	Metallurgy (11) Mineral Chemistry.	5.
Gen'l Chemistry (1) Inorganic.	5.	Gen'l Chemistry (3) Laboratory.	3.	Mine Engineering (3) Mine Operating.	5.
Mine Engineering (1) Mine Surveying.	5.	Mine Engineering (2) Ventilation & Haulage.	5.	Shopwork (B4) Forging.	3.
Cadet Service.		Cadet Service.		Cadet Service.	

TIME SCHEDULE

SHORT COURSE IN MINING

FIRST YEAR — Geology (1), 8 A. M., daily, or 10 A. M., daily. Mathematics (3), (4), (5), 11 A. M., daily. Mathematics (6), 9 A. M., daily. Physics (1), (2), 8 A. M., or 10 A. M., daily.

SECOND YEAR — Drawing (3), 8-10 A. M., M., W. Drawing (7), Lecture 9 A. M., T., Th., Practice, 10-12 A. M., T., Th. Geology (5), 10 A. M., daily. General Chemistry (1), Lecture 11 A. M., M. (For quiz and laboratory hours, consult the professor). Metallurgy (11), 11 A. M., daily. Mine Engineering (1), (2), (3), 1 P. M., daily. Shopwork (B4), 2-4 P. M., W., Th., F.

DEPARTMENTS OF INSTRUCTION

ARCHITECTURE

Associate Professor Bradford

1. Orders. Five times a week. Second Term.
2. Styles. Five times a week. Third Term.
3. Designing. Five times a week. Three Terms.
4. Specifications. Twice a week. First Term.
5. Decorations. Three times a week. Second Term.
6. Estimates. Four times a week. Third Term.
7. Heating. Five times a week. Second Term.
8. Designing. Five times a week. Third Term.

ASTRONOMY

Professor H. C. Lord

1. Practical Astronomy. Observatory practice with instruments of the Emerson McMillin Observatory. Four times a week. Third Term.
2. Practical Astronomy. Observatory practice. Geodesy. Four times a week. First Term.

CIVIL ENGINEERING

Professor Brown, Mr. ———

1. Land Surveying. Six times a week. First Term.
2. Railroad Surveying. Six times a week. Third Term.
3. Topographical Surveying. Four times a week. First Term.
4. Technical Drawing. Platting, Pen and Colored Typography. Four times a week. Second Term.
5. Technical Drawing. Working Drawings and Blue Printing. Three times a week. Second Term.
6. Stereotomy. Four times a week. Second Term.
7. Bridge Strains. Five times a week. Third Term.
8. Bridge Strains. Five times a week. Third Term.
9. Bridge Designing. Five times a week. First Term.
10. Masonry Construction. Five times a week. First Term.
11. Masonry Construction. Five times a week. Second Term.
12. Railway Location. Five times a week. Second Term.
13. Water Supply. Five times a week. Third Term.
14. Sanitary Engineering. Five times a week. Third Term.
15. Instrument Testing and Adjusting. Twice a week. Second Term.
16. Roof Trusses. Five times a week. First Term.
17. Surveying, with special reference to the needs of an architect. Three times a week. Third Term.

CLAY-WORKING AND CERAMICS

Professor Edward Orton, Jr.

1. Analysis of Limestones and Simple Minerals. Four times a week. First Term.
2. Analysis of Clays. Four times a week. Second Term.
3. Analysis of Clays and Other Bodies. Four times a week. Third Term.
4. General Principles: Clays. Five times a week. First Term.
5. Bricks. Five times a week. Second Term.
6. Pottery. Five times a week. Third Term.
7. Advanced Chemistry. Laboratory: Glasses and Glazes. Five times a week. Second Term.
8. Continuation of Course (7): Enamels and Colors. Five times a week. Third Term.
9. Ceramic Laboratory. Manufacture of Bodies. Five times a week. First Term.
10. Continuation of Course (9): Glasses and Glazes. Second Term.
11. Continuation of Course (10): Enamels and Colors. Five times a week. Third Term.
12. Cement: Manufacture and Testing. Five times a week. Second Term.
13. Ceramic Construction. Twice a week. Second Term.
14. Reports. Five times a week. Third Term.
15. Thesis Work. Five times a week. Third Term.

DRAWING

Professor Bradford, Mr. French, Mr. Lewis

2. Lettering. Three drawing periods a week. Third Term.
3. Freehand Drawing. Two drawing periods a week. First Term.
4. Freehand Drawing. Two drawing periods a week. First and Second Terms.
5. Freehand Drawing. Three drawing periods a week. Three terms.
6. Freehand Drawing. One drawing period a week. Three terms.
7. Mechanical Drawing. Urthographic, Isomatic and Oblique Projections. One lecture and two drawing periods a week. First Term.
8. Descriptive Geometry. Two lectures and one drawing period a week. Second Term.
9. Descriptive Geometry. Two lectures and three drawing periods a week. Second Term.
10. Shades, Shadows and Perspective. One lecture and one drawing periods a week. Third Term.
11. Shades, Shadows and Perspective. One lecture and four drawing periods a week. Third Term.
12. Draughting and Blue Printing. Three drawing periods a week. Second Term.

13. Technical Drawing. Working drawings, machine designing, etc. Three drawing periods a week. First Term.
14. Photography. Twice a week. First or Third Term.
15. Mechanical Drawing. Geometric and projection drawing, lettering. Two drawing periods a week. Three Terms.
16. Mechanical Drawing. Working drawings, tracing, blue-printing, descriptive geometry, shades, shadows and perspective. Three drawing periods a week. Three Terms.
17. Mechanical Drawing. One lecture and four drawing periods a week. Third Term.
18. Clay Modelling. Two drawing periods a week. Three Terms.
19. Technical and Decorative Design. Two drawing periods a week. Three Terms.
20. Pen Drawing. Two drawing periods a week. First Term.
21. Clay Modelling. Two drawing periods a week. Second and Third Terms.

ELECTRICAL ENGINEERING

Assistant Professor Caldwell

1. Dynamos, Electric Machinery, Lamps, Storage Batteries, Street Car and Mining Applications of Electricity, Electric Plants, Contracts. Five times a week. First and Second Terms.
2. Continuation of Course (1). Three times a week. Third Term.
3. Designing and Drawing. Three times a week. First and Second Terms.
4. Designing and Drawing: Continuation of Course (3). Five times a week. Third Term.
5. Laboratory. Three half-days a week. Three Terms.
6. Laboratory. Three laboratory periods a week. First and Second Terms.
7. Laboratory. Three laboratory periods a week. Third Term.

FRENCH

Professor Bowen, Mr. Bruce

1. Elementary French. Four times a week. Three Terms.
3. Science Reading. (Optional.) Twice a week. Three Terms.
Open to all who have had Course (1), or who enter with French.

GENERAL CHEMISTRY

Professor McPherson

1. Inorganic Chemistry. One lecture, one quiz and three laboratory periods a week. Three Terms.
2. Qualitative Analysis. Five laboratory periods a week. Third Term.
3. Quantitative Analysis. Three laboratory periods a week. Second Term.

GEOLOGY

Dr. Orton, Mr. Bownocker

1. Physical Geography. Five times a week. Third Term.
2. Cosmical, Lithological, Dynamical and Structural Geology. Five times a week. First Term.
3. Paleontological and Historical Geology. Five times a week. Second Term.
4. Economic Geology. Five times a week. Second Term.
5. Elementary Geology. Five times a week. Second Term.

GERMAN

Professor Eggers, Mr. Eisenlohr

1. Elementary German. Four times a week. Three Terms.
3. Science Reading (optional). Twice a week. Three Terms. Open to all who have credit for Course (1), or who enter with German.

INDUSTRIAL ARTS

Professor Williston

3. Hand and Machine Tools. Three times a week. Three Terms.
4. Technical Drawing, Designing. Three drawing periods a week. Second Term.
5. Technical Drawing, Designing. Three drawing periods a week. Third Term.
6. Shop Equipment, Appliances and Management. Three times a week. Three Terms.
7. Advanced Technical Drawing, Designing. Continuation of Courses (4) and (5). Three drawing periods a week. Three Terms.
8. Shop Appliances. Twice a week. Second Term.

MATHEMATICS

Professor Bohannan, Asst. Professor McCoard, Mr. Arnold, Mr. Swartzel, Lieut. Martin, Associate Professor Ray

1. Easy Algebra. Five times a week. First Term.
2. Plane Geometry. Five times a week. Second Term.
3. Plane Geometry. Five times a week. First Term.
4. Solid Geometry. Five times a week. Second Term.
5. Plane Trigonometry. Five times a week. Third Term.
6. Elementary Algebra. Five times a week. Three Terms.
7. Plane Trigonometry. Five times a week. First Term.
8. Analytic and Spherical Trigonometry. Twice a week. Second Term.
9. College Algebra. Three times a week. Second Term.
10. Plane Analytics. Five times a week. Third Term.
11. Space Analytics and Differential Calculus. Five times a week. First Term.
12. Differential Calculus. Five times a week. Second Term.

13. Integral Calculus. Five times a week. Third Term.
14. Differential Equations. Twice a week. First Term.
15. Least Squares. Twice a week. First Term.
16. Plane Geometry. Five times a week. Second Term.

MECHANICAL ENGINEERING

Professors Magruder and Williston, Assistant Professor Hitchcock

1. Analytic Mechanics. Five times a week. First and Second Terms.
2. Strength of Materials. Five times a week. Third Term.
3. Timber and Masonry. Three times a week. Second Term.
4. Mechanism. Five times a week. Second Term.
5. Mechanism. Twice a week. Third Term.
6. Thermodynamics. Five times a week. First Term.
7. Prime Movers. Five times a week. Second Term.
8. Machinery and Millwork. Five times a week. Third Term.
9. Invention and Designing. Five times a week. First Term.
10. Testing Laboratory. Twice a week. First Term.
11. Testing Laboratory. Three times a week. Second Term.
12. Testing Laboratory. Three times a week. Third Term.
13. Testing Laboratory. Four times a week. Third Term.
14. Testing Laboratory. Five times a week. First Term.
15. Technical Drawing. Five drawing periods a week. Third Term.
16. Machine Designing. Five times a week. First and Second Terms.
17. Hydraulic Machinery. Twice a week. Third Term.
18. Thesis Work. Five times a week. Third Term.
19. Materials of Construction. Five times a week. First Term.

METALLURGY

Professor N. W. Lord

1. Crystallography and Practical Mineralogy. Three times a week. Third Term.
2. Laboratory: Analysis of iron, steel, ores, clays, etc. Five laboratory periods a week. Three Terms.
3. The Useful Metals and Their Ores. Five times a week. First and Second Terms.
4. The Useful Metals and their Ores. Continuation of Course 3. Five times a week for two-fifths of the Second Term.
5. The Useful Metals and their Ores. Five times a week. Second Term.
6. Assaying: Laboratory. Five laboratory periods a week. Second Term.
7. Determinative Mineralogy: Laboratory. Three laboratory periods a week. Third Term.
8. Metallurgical Construction. Three times a week. First Term.
9. Ore Dressing. Twice a week. First Term.
10. Plans and Specifications. Five times a week. Third Term.
11. Mineral Chemistry. Five times a week. Third Term.

MINE ENGINEERING

Associate Professor Ray

1. Mine Surveying. Five times a week. First Term.
2. Ventilation and Haulage. Five times a week. Second Term.
3. Mine Operating. Five times a week. Third Term.
4. Mine Surveying. Five times a week in the field. First Term.
5. Mine Engineering. Five times a week. Three Terms.

PHYSICS

Professor Thomas, Asst. Professor Boyd, Mr. Kester.

1. Elementary Physics, with laboratory practice. Five times a week. First Term.
2. Continuation of Course (1). Five times a week. Second Term.
3. Mechanics and Heat. Three times a week. First Term.
4. Electricity and Magnetism. Three times a week. Second Term.
5. Sound and Light. Three times a week. Third Term.
6. Drill in Working Problems: Continuation of Courses (3), (4), (5). Twice a week. Three Terms.
7. Electricity and Magnetism. Three times a week. First Term.
8. Laboratory. Measurements of length, mass, time, density, elasticity, heat, etc. Three laboratory periods a week. Second Term.
9. Laboratory. Measurements in Heat, Electricity, Magnetism. Three laboratory periods a week. Third Term.
10. Laboratory. Measurements in Electricity, Magnetism. Light. Four laboratory periods a week. First Term.
11. Continuation of Course (10): Five laboratory periods a week. Second Term.
12. Continuation of Course (11): Five laboratory periods a week. Third Term.
13. Laboratory. Two laboratory periods a week. Second Term.
14. Laboratory. Three laboratory periods a week. Third Term.

RHETORIC

Professor Denney, Mr. Graves

1. Paragraph Writing. Twice a week. First Term.
2. Theme Writing. Twice a week. Second Term.
3. Prose Analysis. Twice a week. Third Term.
4. Advanced Composition. Twice a week. Three Terms.
5. Advanced Rhetoric. Twice a week. Three Terms.

SHOP-WORK.

Professor Williston, Mr. Weick, Mr. Knight, Mr. ——

(A) Carpentry and Pattern Making —
   1. Six hours' practice. Three Terms.
   2. Six hours' practice. First and Second Terms.
   3. Eight hours' practice. Third Term.
   4. Four hours' practice. First Term.

(B) Forging —
  1. Six hours' practice. First and Second Terms.
  2. Six hours' practice. First Term.
  3. Four hours' practice. Second Term.
  4. Six hours' practice. Third Term.
  5. Ten hours' practice. First Term.

(C) Advanced Pattern Making and Foundry Work —
  1. Four hours' practice. First Term.

(D) Chipping and Filing —
  1. Six hours' practice. Third Term.
  2. Six hours' practice. Second Term.
  3. Four hours' practice. First Term.
  4. Four hours' practice. Third Term.
  5. Ten hours' practice. First Term.

(E) Machine Work —
  1. Six hours' practice. Three Terms.
  2. Six hours' practice. First Term.
  3. Eight hours' practice. Second Term.
  4. Ten hours' practice. Second Term.
  5. Six hours' practice. Three Terms.
  6. Eight hours' practice. Second Term.
  7. Ten hours' practice. Third Term.
  8. Six hours' practice. Second Term.

(F) Carpentry and Forging —
  1. Eight hours' practice. Third Term.

(G) Forging, Chipping, Filing —
  1. Ten hours' practice. Third Term.

(H) Foundry —
  1. Six hours' practice. Third Term.

ADMISSION TO SPECIAL STUDIES

Students who desire to pursue special lines of work in any of the Colleges of the University, and do not desire to become candidates for degrees, will be admitted on the following conditions :

1. The regular entrance requirements must be satisfied.

2. But applicants who are not less than twenty-one years of age,* after obtaining credit for elementary or "grade" work, and for such

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*Eighteen years, in the College of Engineering.

other subjects as may be necessary to qualify them for the classes that they wish to enter, may, on the presentation of satisfactory reasons, be admitted by the proper Faculty to any class in the University; provided, that if any student who has been admitted on these conditions afterwards becomes a candidate for a degree, he shall take the omitted entrance examinations at least twelve months before the degree is conferred.

3. On entering the University, students desiring to pursue special work are required to lay before the proper Faculty, for approval or modification, a written statement of the end they have in view, the studies proposed for the attainment of that end, and the probable period of attendance. Such students will be held as strictly to their accepted schemes of work as are the regular undergraduates to their courses of study.

4. *Permission to enter as special undergraduates will be refused to all who fail to give satisfactory evidence of definiteness of purpose, and will be withdrawn whenever the conditions on which it was granted cease to exist.*

ADMISSION TO ADVANCED STANDING

1. Applicants who do not come from some other University or College must first obtain admission to some College of the University in the manner already described. They will then be examined on the undergraduate studies for which they ask credits.

2. Applicants who come from the collegiate department of an approved College, and who bring explicit and official certificates describing their course of study and scholarship, and also certificates of honorable dismission, will be admitted without examination except such as may be necessary to determine what credit they are to receive here for work done in the College from which they come.

EXPENSES

Fees

Each student is required to pay an incidental fee of fifteen dollars a year, and the usual fees for the expenses of laboratory work. *Tuition is free.*

All students are required to register and pay their fees before the first day for class-work of each year. Office hours are from 8 A. M. to 12 M., and from 1 to 5 P. M., central standard time.

Former students who fail to register as above will be subject to a charge of one dollar in addition to the usual incidental fee, for the first day of delinquency, and fifty cents additional for each subsequent day.

A fee of five dollars to cover expenses of graduation, diplomas, etc., is required of each person receiving one of the ordinary degrees from the University, and this fee must be paid before the degree is conferred.

OTHER EXPENSES

There are two dormitories on the University grounds for the use of students. Each occupant is charged by the University a rent of one dollar and fifty cents a term.

The South Dormitory affords unfurnished rooms to such students as desire to board themselves, and thus to reduce their expenses to a minimum. The expense of living in this way falls below two dollars per week. Applications for rooms should be made to the President of the University.

The North Dormitory will accommodate more than sixty students. Board, furnished rooms, fuel, light and washing are, at present prices, supplied for about three dollars and twenty-five cents a week. Students will be admitted on special recommendation to the President of the University.

Boarding clubs are also formed in the neighborhood of the University. Furnished rooms are rented at seventy-five cents to one dollar a week for each student, and the cost of board is two dollars to three dollars a week.

Board, with furnished rooms, can be obtained in private families, within convenient distances of the University, at rates varying from four dollars to five dollars a week. The ruling rate may be taken as four dollars.

The uniform with which the members of the battalion are required to provide themselves costs about fourteen dollars. It is quiet in pattern, and is designed to be worn daily in place of civilian dress.

The expenses of a student in this College for a year may be estimated as follows, excluding clothing (except uniform) and traveling expenses :

	Low	Average	High
Incidental fees	$15 00	$15 00	$15 00
Laboratory fees	15 00	15 00	54 00
Books and stationery	15 00	25 00	40 00
Room	4 50	37 00	75 00
Furniture	10 00	......	......
Board.	70 00	110 00	150 00
Uniform	14 00	14 00	14 00
	$143 50	$216 00	$348 00

The second and third estimates for room include light, fuel and care. The third estimate is for a room occupied by a single student. The requirements for laboratory fees and books depend upon the course of study pursued.

SELF-SUPPORT.

There is a large amount of work upon the University farm which is assigned to students, preference being given to those who are studying Agriculture. *But the University can not promise work to all applicants.* Many students find work in private families and in various occupations, by means of which they defray at least a portion of their expenses. A person of ability and energy, who is master of a trade, or who can do good work of any kind, can generally find remunerative employment. It has seldom been known that any student of ordinary energy and industry was ever obliged to leave the University because of a lack of money for necessary expenses, *after having been say sixty days on the ground* — or long enough to inform himself as to the opportunities for securing employment. An employment bureau is maintained at the University, where the names of those seeking work and of those desiring workers are recorded.

For further information address "Executive Office, State University, Columbus, Ohio."

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1895/96

OHIO STATE UNIVERSITY

School of Engineering

CIRCULAR OF INFORMATION

COURSES IN —
Civil, Mining, Mechanical, and Electrical
Engineering, Industrial Arts, Clay Working,
and Ceramics, and the Short Course
in Mining

1895-1896

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COLUMBUS
PUBLISHED BY THE UNIVERSITY
1895

The Ohio State University.

GENERAL STATEMENT.

THE UNIVERSITY AND THE STATE.

Under the act of Congress passed July 2, 1862, the State of Ohio received from the United States a large grant of the public lands for the purpose of establishing a "college, where the leading objects shall be without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such a manner as the Legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life." In accordance with this act, the Ohio State University was founded by the State as a public institution of learning. The governing body of the institution is a Board of Trustees, appointed by the Governor of the State for terms of seven years, as provided in the law organizing the University. The original endowment has been supplemented, and the objects of the University promoted, by a permanent annual grant from the United States, under an act of 1890; by special appropriations of the General Assembly; and lastly, in 1891, by a permanent annual grant from the State. In accordance with the spirit of the law under which it is organized, the University aims to furnish ample facilities for education in the liberal and industrial arts, the sciences and the languages, and for thorough technical and professional study of agriculture, engineering in its various departments, veterinary medicine, pharmacy and law. Through the aid which has been received from the United States and from the State, it is enabled to offer its prsvileges, with a slight charge for incidental expenses, to all persons, of either sex, who are qualified for admission.

LOCATION OF THE UNIVERSITY.

The University is situated within the corporate limits of the city of Columbus, two miles north of the Union Depot and about three miles from the State Capitol. The University grounds consist of three hundred and thirty acres.

It may be reached by either the North High Street or Neil Avenue electric cars. Those wishing to go to the principal buildings of the University or to the residences on the grounds, should take a High Street car going north. Those wishing to visit the Veterinary Hospital, Agricultural and Horticultural buildings, the Dormitories or the athletic field will find the Neil Avenue cars more convenient.

Announcements.

1895.

Entrance Examinations, 8:15 A. M.	Monday, Tuesday,	September 9. September 10.
First Term begins: Registration Day	Wednesday,	September 11.
Thanksgiving Recess	Thursday, Friday,	November 28. November 29.
First Term ends	Wednesday,	December 18.

1896.

Second Term begins	Wednesday,	January 8.
Second Term ends	Friday,	March 27.
Third Term begins	Monday,	March 30.
COMMENCEMENT	Wednesday,	June 17.

Board of Trustees.

		Term Expires
THOMAS J. GODFREY	Celina	May 13, 1896
JOHN B. SCHUELLER	Columbus	" 1897
JAMES E. CAMPBELL	Hamilton	" 1898
WILLIAM I. CHAMBERLAIN	Hudson	" 1899
DAVID M. MASSIE	Chillicothe	" 1900
JOHN T. MACK	Sandusky	" 1901
LUCIUS B. WING	Newark	" 1902

OFFICERS OF THE BOARD.

DAVID M. MASSIE.	*President.*
JOHN T. MACK	*Vice President.*
ALEXIS COPE, 170 North High Street	*Secretary.*
FRED. W. PRENTISS	*Treasurer.*

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The School of Engineering.

OFFICERS.

PRESIDENT.

*WILLIAM HENRY SCOTT, M. A., LL. D., University Grounds

STANDING COMMITTEE.

President Scott, *Chairman;* Professor Thomas, *Secretary;* Professors Robinson, Lord, Bohannan, Brown, Eggers, Williston, Orton, Jr., and Associate Professor Bradford.

I. INSTRUCTORS IN THE ENGINEERING DEPARTMENT.

STILLMAN W. ROBINSON, C. E., 1353 Highland Street
Professor of Mechanical Engineering.

NATHANIEL W. LORD, E. M., 1175 Highland Street
Professor of Mining and Metallurgy.

BENJAMIN FRANKLIN THOMAS, Ph. D., University Grounds
Professor of Physics. In charge of Electrical Engineering.

C. NEWTON BROWN, C. E., 1343 Forsyth Avenue
Professor of Civil Engineering.

ARTHUR LYMAN WILLISTON, S. B., 652 Franklin Avenue
Director of the Industrial Department.

EDWARD ORTON, Jr., E. M., 36 North Monroe Avenue
Director of the Department of Clayworking and Ceramics.

FRANCIS CARY CALDWELL, B. A., M. E., 191 King Avenue
Assistant Professor of Physics.

FRANK A. RAY, E. M., The Normandie
Assistant Professer of Mining Engineering.

FRANK J. COMBS, 1173 Franklin Avenue
Assistant in the Industrial Department and Foreman of the Forge Room.

EDWARD A. KEMMLER, C. E., 888 City Park Avenue
Assistant in Civil Engineering.

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*Resigned. President-elect James H. Canfield will assume duties September 1895.

EMBURY A. HITCHCOCK, M. E., 191 King Avenue
Assistant in Mechanical Engineering.

CHARLES W. WEICK, 30 East Ninth Avenue
Assistant in the Industrial Department and Foreman of the Carpenter and Pattern Shops.

WILLIAM A. KNIGHT, 206 West Lane Avenue
Assistant in the Industrial Department and Foreman of the Machine Shops.

CHARLES WILLIAM DAVIS, E. M., 204 West Fourth Avenue
Fellow and Assistant in Mining and Metallurgy.

II. OTHER TEACHERS WHO GIVE INSTRUCTION IN THE ENGINEERING COURSES.

EDWARD ORTON, Ph. D., LL. D., 100 Twentieth Street
Professor of Geology.

SIDNEY A. NORTON, Ph. D., LL. D., 363 East Town Street
Professor of General and Applied Chemistry.

HENRY A. WEBER, Ph. D., 1342 Forsyth Avenue
Professor of Agricultural Chemistry.

ROSSER DANIEL BOHANNAN, B. Sc., C. E., E. M., 16th and Indianola Aves.
Professor of Mathematics and Astronomy.

DAVID SIMONS KELLICOTT, Ph. D., 1332 Highland Street
Professor of Zoology and Entomology.

ERNST AUGUST EGGERS, 644 Franklin Avenue
Professor of the German Language and Literature.

ALBERT M. BLEILE, M. D., 218 King Avenue
Professor of Anatomy and Physiology.

EUGENE T. WILSON, 2d Lieut. 1st Artillery, U. S. A., 281 East Broad Street
Professor of Military Science and Tactics.

WILLIAM A. KELLERMAN, Ph. D., 175 West Eleventh Avenue
Professor of Botany.

BENJAMIN LESTER BOWEN, Ph., D., 1351 Forsythe Street
Professor of the Romance Languages and Literatures.

JOSEPH VILLIERS DENNEY, B. A., Sixteenth and Indianola Avenues
Professor of Rhetoric and Secretary of the University Faculty.

JOSEPH NELSON BRADFORD, M. E., 54 West Tenth Avenue
Associate Professor of Drawing.

OLIVE JONES, 71 West Eleventh Avenue
Librarian.

GEORGE W. McCOARD, M. A., 1322 Neil Avenue
Assistant Professor of Mathematics.

WILLIAM McPHERSON, Jr., M. Sc., Fifteenth and Indianola Avenues
Assistant Professer of General Chemistry.

HENRY CURWEN LORD, B. Sc., 169 King Avenue
Assistant Professor of Astronomy and Mathematics.

CHARLES WALTER MESLOH, B. A., 9 Lyndon Block, Fifth Ave. and High St.
Assistant in German.

JOSEPH RUSSELL TAYLOR, B. A., 191 King Avenue
Assistant in Rhetoric.

CHARLES LINCOLN ARNOLD, M. Sc., 239 West Tenth Avenue
Assistant in Mathematics.

CHARLES B. MORREY, B. A., University Grounds
Assistant in Physiology.

LLOYD MORRIS BLOOMFIELD, B. Agr., University Grounds
Assistant in Agricultural Chemistry.

JAMES ELLSWORTH BOYD, B. Sc., 159 West Frambes Avenue
Assistant in Physics.

THOMAS EWING FRENCH, 1458 Worthington Street
Assistant in Drawing.

FLORENCE BASCOM, Ph. D., Fifteenth and Indianola Avenues
Assistant in Geology.

NEWTON HENRY BROWN, M. E., 114 Norwich Avenue
Assistant in Physics.

CHARLES ROGER WATSON, A. B., 106 North Grant Avenue
Assistant in French and Latin.

JOSEPH C. RITCHEY, B. Sc., University Grounds
Assistant in General Chemistry.

THOMAS KENYON LEWIS, B. Sc., 32 West Ninth Avenue
Assistant in Drawing.

HARRIET TOWNSHEND, University Grounds
Assistant Librarian.

KARL DALE SWARTZEL, M. Sc., 57 West Frambes Avenue
Fellow and Assistant in Mathematics.

JAMES HOWARD McGREGOR, B. Sc., 234 West Tenth Avenue
Fellow and Assistant in Zoology and Entomology.

Ohio State University.

ORGANIZATIONS OF THE UNIVERSITY.

The University comprises the Collegiate Department, the School of Law, and a Preparatory Department.

The Collegiate Department embraces the following schools: Arts and Philosophy, Science, Agriculture, Engineering, Pharmacy, and Veterinary Medicine. Each School is under the direction of a standing committee of the Faculty.

THE SCHOOL OF ENGINEERING.

The School of Engineering consists of those departments represented in the Courses leading to the degrees of Civil Engineer, Engineer of Mines, Mechanical Engineer, Bachelor of Science in Industrial Arts, in the Short Course in Mining and in the Course in Clayworking and Ceramics.

COURSE OF STUDY.

The following Courses of study lead to the degrees indicated in each case:

1. The Course of Civil Engineering, for the degree of Civil Engineer (C. E.).
2. The Course in Mining Engineering, for the degree of Engineer of Mines (E. M.).
3. The Course in Mechanical Engineering, for the degree of Mechanical Engineer (M. E.).
4. The Course in Electrical Engineering, for the degree of Mechanical Engineer (M. E.).
5. The Course in Industrial Arts, for the degree of Bachelor of Science in Industrial Arts (B. Sc.).

Short Courses not leading to a degree:

6. The Short Course in Mining, two years in length.
7. The Course in Clayworking and Ceramics, two years in length.

Department of Civil Engineering.

The facilities provided for the illustration of the courses in civil engineering and practical training are as follows: One high grade and three ordinary transits, three leveling instruments, solar compass, prismatic compass, improved telescope compass, Abney hand level, level and stadia rods, sight poles, chains, tapes; twenty-six improved drawing tables with 30″ by 36″ top; Schroeder's models in stereotomy and roof trusses; large set of models of wooden joints; collection of photographs of bridges both when finished and in course of erection; collections of strain sheets and shop drawings of bridges, new improved cement testing machine and outfit for making all kinds of cement tests; stone mason's tools for working models out of plaster blocks; magic lantern and slides; calculating machines; sets of drawing instruments; blue-print room with outfit; set of tracings of standard structures from which each student makes a set of blue-prints. The equipment is growing each year by the addition of materials purchased, presented, or made by students of the Department.

COURSE IN CIVIL ENGINEERING.

This Course is arranged for students expecting to become surveyors or civil engineers. The plan of the course is to give (1) a thorough training in mathematics and mechanics, (2) the general principles underlying all branches of civil engineering, (3) the application of the general principles to the several branches of civil engineering. The subjects of land, railroad and topographical surveying are important features, and students can at once begin practical work. In the engineering work special attention is given to iron and steel bridge work, masonry construction and cement testing, road and railroad building and maintenance, water supply and the subject of the collection and disposal of sewage.

Note.—The figure in parenthesis following the name of a study indicates the number of the course in that subject, a full description of which will be found under that name and number in the "Courses of Instruction,"

FRESHMAN YEAR.

First Term.	Hours per week.	Second Term.	Hours per week.	Third Term.	Hours per week.
Drawing (1) Freehand.	1.	Drawing (1) Freehand.	1.	Drawing (2) Lettering.	2.
English (1) Practical Rhetoric.	2.	English (1) Practical Rhetoric.	2.	English (1) Practical Rhetoric.	2.
French (1) Elementary. or German (1) Elementary.	5.	French (1) Elementary. or German (1) Elementary.	5.	French (1) Elementary. or German (1) Elementary.	5.
Gen'l Chemistry (1) Principles.	4.	Gen'l Chem.(1)&(1*a*) Lectures and Laboratory.	5.	Metallurgy (2) Mineralogy.	3.
Mathematics (6) Trigonometry.	5.	Mathematics (6) Trigonometry and Algebra.	5.	Mathematics (6) Analytical Geometry.	5.
Military Drill.		Military Drill.		Military Drill.	
		Tactics.	2.		

SOPHOMORE YEAR.

First Term.	Hours per week.	Second Term.	Hours per week.	Third Term.	Hours per week.
Civil Engineering (1) Surveying.	6.	Civil Engineering (4) C. E. Drawing.	4.	Civil Engineering (2) Surveying.	6.
Drawing (3) Mechanical.	3.	Drawing (3) Mechanical.	5.	Drawing (3) Mechanical.	3.
French (3) Scientific. or German (2) Scientific.	2.	French (3) Scientific. or German (2) Scientific.	2.	French (3) Scientific. or German (2) Scientific.	2.
Mathematics (7) Analytics and Calculus.	5.	Mathematics (7) Calculus.	5.	Mathematics (7) Calculus.	5.
Physics (2) Mechanics and Heat.	3.	Physics (2) Electricity.	3.	Physics (2) Sound and Light.	3.
Military Drill.		Military Drill.		Military Drill.	
		Art of War,	2		

JUNIOR YEAR.

First Term.	Hours per week.	Second Term.	Hours per week.	Third Term.	Hours per week.
Civil Engineering (3) Surveying.	4.	Civil Engineering (6) Stereotomy.	4.	Civil Engineering (7) Bridge Strains.	5.
English (3) Advanced Rhetoric.	2.	English (3) Advanced Rhetoric.	2.	English (3) Advanced Rhetoric.	2.
Geology (2) General.	5.	Geology (2) General.	5.	Drawing (7) Photography.	2.
Mathematics (8) Least Squares.	2.	Civil Engineering (5) C. E. Drawing.	3.	Astronomy (2) Mathematical.	4.
Mechan'l Engin'g (6) Mechanics.	5.	Mechan'l Engin'g (6) Mechanics.	5.	Mechan'l Engin'g (7) Strength of Materials.	5.

SENIOR YEAR.

First Term.	Hours per week.	Second Term.	Hours per week.	Third Term.	Hours per week.
Astronomy (2) Mathematical.	3.	Astronomy (2) Mathematical.	2.		
Civil Engineering (8) Bridge Designing.	5.	Civil Engineer'g (14) Laboratory.	2.		
Civil Engineering (9) Masonry.	5.	Civil Engineering (9) Lectures.	5.	Civil Engineering (9) Water Supply.	5.
		Mechan'l Engin'g (2) Laboratory.	3.	Civil Engineer'g (10) Sanitary Engineering.	5.
Physics (7) Laboratory.	5.	Geology (3) Economic.	5.	Physics (7) Laboratory.	5.

THESIS.

As a requisite for graduation, each candidate must present an acceptable thesis, embodying the results of a special study. The subject of the study must lie within the field of Civil Engineering. The subject must be announced to the President of the University (dependent upon the approval of the head of the department), not later than the beginning of the second term of the Senior year, and the completed thesis must be submitted not later than the second Saturday before Commencement Day.

Department of Mining and Metallurgy.

The Department of Mining and Metallurgy occupies the eastern part of Chemical Hall. In the basement are the smelting furnaces, the assay laboratory, a room for rough work, and store rooms for supplies. On the first floor is the lecture room of the professor in charge, twenty-five by twenty-six feet, with a seating capacity of forty, a laboratory with desks for sixteen students, a store room, a balance room, a private laboratory, and an office. On the second floor is the lecture room of the assistant professor, a draughting room, a room for instruments, and an office.

The draughting room is large, well lighted, and provided with a desk for each student. A workshop in the attic is fitted with tools for making models, and for experiments in ventilation. The metallurgical laboratory has all the appliances for the most modern methods of technical analysis as practiced in iron and steel laboratories, including gas analysis. A furnace room in the basement is fitted for gold and silver assaying, with improved muffle and crucible furnaces.

The lecture room in metallurgy has arrangements for projecting photographs of machines, mines, and furnaces, for class illustration, and there is a large collection of such views. There is a photographic room with blue-printing facilities, where students learn to make copies of the drawings used in illustrating the lectures.

A collection of minerals and rocks with a large set of rock sections is provided for illustrating the mineralogy, as well as sets of blow-pipe apparatus for the students in determinative mineralogy.

COURSE IN MINING ENGINEERING.

This Course is arranged for students intending to become mining engineers and surveyors, metallurgical or technical chemists. The plan of work, therefore, while keeping mathematics, drawing and engineering prominent, also provides extended work in applied chemistry, chemical analysis, assaying, mineralogy, geology, and surveying with especial application to mines and underground work, while the treatment of ores, both mechanical in ore dressing and chemical in metallurgy, forms an important feature.

Note.—The figure in parenthesis following the name of a study indicates the number of the course in that subject, a full description of which will be found under that name and number in the "Course of Instruction."

FRESHMAN YEAR.

First Term.	Hours per week.	Second Term.	Hours per week.	Third Term.	Hours per week.
Agr'l Chemistry (1) Principles.	5.	Agr'l Chemistry (3) Analytical.	5.	Metallurgy (2) Mineralogy.	3.
Drawing (1) Freehand.	1.	Drawing (1) Freehand.	1.	Drawing (2) Lettering.	2.
English (1) Practical Rhetoric.	2.	English (1) Practical Rhetoric.	2.	English (1) Practical Rhetoric.	2.

FRESHMAN YEAR—Continued.

First Term.	Hours per week.	Second Term.	Hours per week.	Third Term.	Hours per week.
French (1) Elementary. or German (1) Elementary.	5.	French (1) Elementary. or German (1) Elementary.	5.	French (1) Elementary. or German (1) Elementary.	5.
Mathematics (6) Trigonometry.	5.	Mathematics (6) Trigonometry and Algebra.	5.	Mathematics (6) Analytical Geometry.	5.
Military Drill.		Military Drill.		Military Drill.	
		Tactics,	2.		

SOPHOMORE YEAR.

First Term.	Hours. per week.	Second Term.	Hours. per week.	Third Term.	Hours. per week.
Drawing (3) Mechanical.	3.	Drawing (3) Mechanical.	3.	Drawing (3) Mechanical.	3.
English (3) Advanced Rhetoric.	2.	English (3) Advanced Rhetoric.	2.	English (3) Advanced Rhetoric.	2.
French (3) Scientific. or German (2) Scientific.	2.	French (3) Scientific. or German (2) Scientific.	2.	French (3) Scientific. or German (2) Scientific.	2.
Mathematics (7) Analytics and Calculus.	5.	Mathematics (7) Calculus.	5.	Mathematics (7) Calculus.	5.
Metallurgy (5) Laboratory.	5.	Metallurgy (5) Laboratory.	5.	Metallurgy (5) Laboratory.	5.
Shop Work (1) Carpentry.	2.	Shop Work (2) Forging.	2.	Shop Work (4) Chipping and Filing.	2.
Military Drill.		Military Drill.		Military Drill.	
		Art of War,	2.		

JUNIOR YEAR.

First Term.	Hours per week.	Second Term.	Hours per week.	Third Term.	Hours per week.
Mechan'l Engin'g (6) Mechanics.	5.	Mechan'l Engin'g (6) Mechanics.	5.	Mechan'l Eng'g (7) Strength of Materials.	5.
Metallurgy (4) Lectures.	5.	Metallurgy (4) Lectures.	5.	Civil Engineer'g (7) Bridge Strains.	5.
Mine Engineer'g (4) Mine Surveying.	5.	Metallurgy (6) Assaying.	5.	Metallurgy (3) Determinative Mineralogy.	5.
Physics (2) Mechanics and Heat.	3.	Physics (2) Electricity.	3.	Physics (2) Sound and Light.	3.

SENIOR YEAR.

First Term.	Hours per week.	Second Term.	Hours per week.	Third Term.	Hours per week.
Electrical Engin'g (5) Laboratory.	3.	Electrical Engin'g (5) Laboratory.	3.	Electrical Engin'g (5) Laboratory.	3.
Geology (2) General.	5.	Geology (2) General.	5.	Metallurgy (8) Ore Dressing.	5.
Metallurgy (7) Metallurgical Construction.	3.	Geology (3) Economic.	5.	Metallurgy (10) Plans and Specifications.	5.
Mine Engineer'g (5) Mining Engineering.	5.	Mine Engineer'g (5) Mining Engineering.	5.	Mine Engineer'g (5) Mining Engineering.	5.
Drawing (7) Photography.	2.				

THESIS.

As a requisite for graduation, each candidate must present an acceptable thesis, embodying the results of a special study. The subject of the study must lie within the field of Metallurgy or of Mining Engineering. The subject must be announced to the President of the University (dependent upon the written approval of the head of the department) not later than the beginning of the second term of the Senior year, and the completed thesis must be submitted not later than the second Saturday before Commencement Day.

SHORT COURSE IN MINING.

This Course is intended for students lacking time and preparation for the full Course and is principally designed for those who have had some practical experience as miners. The work is more elementary in character than in the long course, and is made to apply especially to coal mining.

NOTE.—The figure in parenthesis following the name of a study indicates the number of the course in that subject, a full description of which will be found under that name and number in the "Courses of Instruction."

FIRST YEAR.

FIRST TERM.	Hours per week.	SECOND TERM.	Hours per week.	THIRD TERM.	Hours per week.
Mathematics (2)	5.	Mathematics (2)	5.	Mathematics (2)	5.
Algebra.		Algebra.		Algebra.	
Mathematics (4)	5.	Mathematics (4)	5.	Mathematics (4)	5.
Geometry.		Geometry.		Trigonometry.	
Physics (1)	5.	Physics (1)	5.	Geology (1)	5.
Elementary.		Elementary.		Physical Geography.	
Military Drill.		Military Drill.		Military Drill.	

SECOND YEAR.

FIRST TERM.	Hours per week.	SECOND TERM.	Hours per week.	THIRD TERM.	Hours per week.
Drawing (1)	2.	Drawing (4)	3.	Drawing (2)	2.
Freehand.		Draughting.		Lettering.	
Drawing (3)	3.	Geology (4)	5.	Shop Work (2)	3.
Mechanical.		Elementary.		Forging.	
Metallurgy (9)	5.	Metallurgy (9)	2.	Metallurgy (9)	5.
Mineral Chemistry.		Mineral Chemistry.		Mineral Chemistry.	
Mine Engineer'g (1)	5.	Mine Engineer'g (2)	5.	Mine Engineer'g (3)	5.
Mine Surveying.		Ventilation and Haulage.		Mine Operating.	
Military Drill.		Military Drill.		Military Drill.	

Department of Mechanical Engineering.

MECHANICAL HALL was erected in 1879. The material is brick, and the dimensions ninety-three feet front and thirty-two in depth, with a wing eighty feet in length and thirty-two feet in depth. It contains a room fitted up with cases for the care of models, instruments of precision, etc., and a room for instruction in laboratory mechanics and draughting. The remaining rooms contain the engines, hydraulic plant, testing machines, etc. The cost of the building and its equipment was about ten thousand dollars; but repeated and valuable additions have since been made to the outfit.

The greater portion of Mechanical Hall is devoted to laboratory purposes, only one of the six rooms being used exclusively for lectures and recitations, while one of the remaining five is used for a museum and instrument room, containing a cabinet of models, accurate instruments for measuring and testing purposes. and a valuable collection of pictures presented by some of the leading manufacturers of the country.

The laboratory embraces appliances for experimental testing of the resistance of materials; dynamometric measurement of power; lubricant testing; experiments in the flow of fluids and movement of air by power blowers and ventilating fans; engine testing; pressure gauge testing and standardizing; calibration of steam engine indicator springs, and a complete equipment for hydraulic testing.

Among the appliances are a Thurston oil tester; a Riehle testing machine; dynamometers; a complete set of Westinghouse compressed air apparatus; ventilating fan; power blower; 60 H. P. McEwen tandem compound engine, connected to a Deane jet condenser; 100 Buckeye engine; a pair of steam engines, 20 and 30 H. P., connected to a Wheeler surface condenser and Blake vacuum pump, and so arranged as to work duplex, compound, condensing or non-condensing; steam separators; injectors; calorimeters and apparatus for testing steampipe covering. The equipment for hydraulic testing consists of a two-foot standpipe for 300 feet head; a Leffel turbine; Pelton impulse wheel; Rifes hydraulic engine; Roberts water motor; pulsometer; 40 H. P. centrifugal pump; two water bays of 2,500 gallons capacity each; three steam pumps of the Laidlaw-Dunn-Gordon Co., Davidson and Blakeslee makes; Ericsson and Rider hot-air pumping engines; wiers; weighing tanks, etc. All of the engines are fitted up for indicator work. In the boiler houses are a Babcock and Wilson boiler of 500 horse power, and a tubular boiler of 30 horse power, either of which serves for experiments on boilers.

Those who have generously made gifts to the equipment of the Department are as follows: The J. H. McEwen Manufacturing Co., Deane Steam Pump Co., Westinghouse Air Brake Co., Huyett & Smith, Fairbanks & Co., D'Este & Seeley Co., Peuberthy Injector Co., William Sellers Co., Hancock Inspirator Co., Hill Clutch Co., Geo. J. Roberts & Co., Laidlaw-Dunn-Gordon Co., M. T. Davidson, and the Blakeslee Pump Co.

The mechanical laboratory virtually embraces much more than that mentioned above, as there are steam and gas transmission pipes in tunnels for service with the various buildings of the institution, fitted with attachments for conducting experimental tests.

Trips are made also to the manufacturing establishments of the city, where numerous steam and other plants are available for expert testing.

COURSE IN MECHANICAL ENGINEERING.

This Course has for its first object the qualifying of men for the mechanical engineering profession. It aims to embrace preparation for such lines of pursuit as the successful management of machinery in manufacturing establishments; the superintendence of construction; the designing and laying out of machinery plants of mills and factories; the invention of machines for particular purposes, and the designing and drawing of the same, or of the inventions of others, preparatory to construction; the making of calculations or exercising sound judgment respecting strength, shocks, proportion, endurance, and suitability of material for specific purposes, as steel in temper, composition metals, woods, etc.

NOTE.—The figure in parenthesis following the name of a study indicates the number of the course in that subject, a full description of which will be found under that name and number in the "Courses of Instruction."

FRESHMAN YEAR.

FIRST TERM.	Hours per week.	SECOND TERM.	Hours per week.	THIRD TERM.	Hours per week.
Drawing (1) Freehand.	1.	Drawing (1) Freehand.	1.	Drawing (2) Lettering.	3.
English (1) Practical Rhetoric.	2.	English (1) Practical Rhetoric.	2.	English (1) Practical Rhetoric.	2.
French (1) Elementary. or German (1) Elementary.	5.	French (1) Elementary. or German (1) Elementary.	5.	French (1) Elementary. or German (1) Elementary.	5.
Gen'l Chemistry (1) Principles.	4.	Gen. Chem. (1) & (1*a*) Lectures and Laboratory.	5.	Shopwork (1) Carpentry.	3.
Mathematics (6) Trigonometry.	5.	Mathematics (6) Trigonometry and Algebra.	5.	Mathematics (6) Analytical Geometry.	5.
Military Drill.		Military Drill.		Military Drill.	
		Tactics,	2.		

SOPHOMORE YEAR.

FIRST TERM.	Hours per week.	SECOND TERM.	Hours per week.	THIRD TERM.	Hours per week.
Drawing (3) Mechanical.	4.	Drawing (3) Mechanical.	2.		
English (3) Advanced Rhetoric.	2.	English (3) Advanced Rhetoric.	2.	English (3) Advanced Rhetoric.	2.
French (3) Scientific. or German (2) Scientific.	2.	French (3) Scientific. or German (2) Scientific.	2.	French (3) Scientific. or German (2) Scientific.	2.
Mathematics (7) Analytics and Calculus.	5.	Mathematics (7) Calculus.	5.	Mathematics (7) Calculus.	5.
Physics (2) Mechanics and Heat.	3.	Physics (7) Electricity.	2.	Physics (2) Sound and Light.	3.
		Physics (7) Laboratory.	2.	Physics (7) Laboratory.	4.
Shop Work (2) Forging.	3.	Shop Work (4) Chipping.	3.	Shop Work (5) Foundry.	3.
Military Drill.		Military Drill.		Military Drill.	
		Art of War,	2.		

JUNIOR YEAR.

First Term.	Hours per week.	Second Term.	Hours per week.	Third Term.	Hours per week.
Drawing (5) Technical.	3.				
Mechan'l Engin'g (2) Laboratory.	3.	Mechan'l Engin'g (2) Laboratory.	4.	Mechan'l Eng'g (11) Technical Drawing.	5.
Mechan'l Engin'g (3) Mechanism.	2.	Mechan'l Engin'g (3) Mechanism.	5.	Mechan'l Engin'g (3) Mechanism.	4.
Mechan'l Engin'g (6) Mechanics.	5.	Mechan'l Engin'g (6) Mechanics.	5.	Mechan'l Engin'g (7) Strength of Materials.	5.
Physics (7) Laboratory.	2.	Physics (7) Laboratory,	5.	Civil Engineer'g (7) Bridge Strains.	5.
Shop Work (6) Machinery.	3.				
Mathematics (11) Differential Equations.	1.				

SENIOR YEAR.

First Term.	Hours per week.	Second Term.	Hours per week.	Third Term.	Hours per week.
Mechan'l Engin'g (2) Laboratory.	5.	Mechan'l Engin'g (2) Laboratory.	3.	Mechan'l Engin'g (2) Laboratory.	5.
Mechan'l Engin'g (4) Invention and Designing.	3.	Geology (4*a*) Dynamical and Structural.	5.	Mechan'l Engin'g (5) Invention and Designing.	5.
Mechan'l Engin'g (8) Thermodynamics.	5.	Mechan'l Engin'g (9) Prime Movers.	5.	Mechan'l Eng'g (10) Machinery.	5.
Metallurgy (4) Lectures.	5.	Metallurgy (4) Lectures.	5.	Drawing (7) Photography.	2.

THESIS.

As a requisite for graduation each candidate must present an acceptable thesis, embodying the results of a special study. The subject of such study must lie within the field of Mechanical Engineering. The subject must be announced to the President of the University (dependent upon the written approval of the head of the department) not later than the beginning of the second term of the Senior year, and the completed thesis must be submitted not later than the second Saturday before Commencement Day.

Department of Physics and Electrical Engineering.

ELECTRICAL HALL was built in 1889. It is a two-story brick building about seventy-five feet long and forty-five feet wide. Sixty feet of the first floor forms the engine and dynamo room. The floor of this room is of asphalt, laid on a solid concrete foundation. On the second floor is a lecture room, thirty by forty feet, a photometric room, a library room, and three measurement rooms. The building and its outfit are valued at about sixteen thousand dollars, of which ten thousand was appropriated by the General Assembly, and the remainder was presented by various electric companies.

The Department has an excellent equipment of apparatus, to which additions are constantly being made. The apparatus includes a large collection of pieces for illustration of the general lecture room work, but is principally chosen for accurate measurement in the laboratory. A set of standards of length, capacity and mass sent under the act of Congress supplying such sets to the several agricultural colleges, is in the possession of the Department. The pieces are copies of the United States standards made by the Coast Survey at Washington.

The electrical laboratory affords excellent facilities for experimental and practical work with dynamo machinery. Machines of the leading makes are provided for incandescent lighting by continuous and by alternating currents, aggregating a capacity of about two thousand sixteen-candle power lamps. Machines for arc lighting, constant potential and constant currant motors, Lord Kelvin's electric balances for standardizing galvanometers, Siemen's electrodynamometers; Weston and other ammeters, Cardew and Weston voltmeters, Deprez and D'Arsonval galvanometers, photometers, steam engine indicators, Prony brakes, are provided, and enable students to carry out a wide range of experimental work.

Under the laws of Ohio, the professor of physics is *ex officio* State Sealer of Weights and Measures, and all of the standard weights, measures and balances received from the United States government are in the rooms of the Department in the custody of the professor of physics.

An electrical power plant has been installed for the purpose of supplying current for electric lighting and for motors applied to various uses in the several buildings of the University. A 100 H. P. engine in the mechanical laboratory drives a Thompson-Houston multipolar 500 volt generator for the power circuits, and a Westinghouse alternating current generator for the lighting circuits. These circuits extend to Chemical Hall, Hayes Hall, Orton Hall, Electrical Hall, University Hall, and to the farm. The currents are used in driving the ventilating fans, the various machinery, and in electric lighting. The wiring of the buildings and of the circuits in the tunnels was planned and carried out by students of the Electrical Engineering Course. The power plant affords valuable opportunity for experimental work and illustrates the tendency of modern engineering practice.

To this may be added, as a part of the facilities afforded students, the valuable opportunities given by the electric companies of Columbus. The Columbus Electric Light and Power Co., using the Thomson-Houston system for arc and incandescent lighting, and the Columbus Edison Company, using the Edison system of lighting, generously allow us not only to inspect their works, but also to experiment freely with their machinery and circuits.

COURSE IN ELECTRICAL ENGINEERING.

The object of this Course is to prepare students for the various pursuits in which the applications of electricity are prominent. Physics, especially theoretical and applied electricity, and mechanical engineering are naturally the leading subjects of the Course. General theory is treated in ample breadth, and is tested by experiments in well equipped laboratories. The laboratories are so conducted as to afford the student a degree of facility in the use of instruments and machinery only acquired by continued practice.

NOTE.—The figure in parenthesis following the name of a study indicates the number of the course in that subject, a full description of which will be found under that name and number in the "Course of Instruction."

FRESHMAN YEAR.

FIRST TERM.	Hours per week.	SECOND TERM.	Hours per week.	THIRD TERM.	Hours per week.
Drawing (1) Freehand.	1.	Drawing (1) Freehand.	1.	Drawing (2) Lettering.	3.
English (1) Practical Rhetoric.	2.	English (1) Practical Rhetoric.	2.	English (1) Practical Rhetoric.	2.
French (1) Elementary. or German (1) Elementary.	5.	French (1) Elementary. or German (1) Elementary.	5.	French (1) Elementary. or German (1) Elementary.	5.
Gen'l Chemistry (1) Principles.	5.	Gen. Chem. (1) & (1*a*) Lectures and Laboratory.	5.	Shop Work (1) Carpentry.	3.
Mathematics (6) Trigonometry.	5.	Mathematics (6) Trigonometry and Algebra.	5.	Mathematics (6) Analytical Geometry.	5.
Military Drill.		Military Drill.		Military Drill.	
		Tactics,	2.		

SOPHOMORE YEAR.

FIRST TERM.	Hours per week.	SECOND TERM.	Hours per week.	THIRD TERM.	Hours per week.
Drawing (3) Mechanical.	4.	Drawing (3) Mechanical.	2.		
English (3) Advanced Rhetoric.	2.	English (3) Advanced Rhetoric.	2.	English (3) Advanced Rhetoric.	2.
Mathematics (7) Analytics and Calculus.	5.	Mathematics (7) Calculus.	5.	Mathematics (7) Calculus.	5.
Physics (2) Mechanics and Heat.	3.	Physics (2) Electricity.	3.	Physics (2) Sound and Light.	3.
Physics (3) Advanced.	2.	Physics (3) Advanced.	2.	Physics (3) Advanced.	2.
		Physics (5) Laboratory.	3.	Physics (5) Laboratory.	5.
Shop Work (2) Forging.	3.	Shop Work (4) Chipping.	2.	Shop Work (5) Machinery.	2.
Military Drill.		Military Drill.		Military Drill.	
		Art of War,	2.		

VOLUNTARY.

French (3) 2, (Scientific Reading); or German (2) 2, (Scientific Reading).

JUNIOR YEAR.

First Term.	Hours per week.	Second Term.	Hours per week.	Third Term.	Hours per week.
Drawing (5) Technical.	3.				
Mechan'l Engin'g (3) Mechanism.	2.	Mechan'l Engin'g (3) Mechanism.	5.	Mechan'l Engin'g (2) Laboratory.	4.
Mechan'l Engin'g (6) Mechanics.	5.	Mechan'l Engin'g (6) Mechanics.	5.	Mechan'l Engin'g (7) Strength of Materials.	5.
Physics (6) Laboratory.	4.	Physics (6) Laboratory.	5.	Physics (6) Laboratory.	5.
Physics (4) Electricity and Magnetism.	3.	Shopwork (6) Machinery.	4.	Mechan'l Engin'g(11) Technical Drawing.	5.
Mathematics (8) Least Squares.	2.				

SENIOR YEAR.

First Term.	Hours per week.	Second Term.	Hours per week.	Third Term.	Hours per week.
Electrical Engin'g (2) Electrical Machinery.	5.	Electrical Engin'g (2) Electrical Machinery.	5.	Electrical Engin'g (2) Electrical Machinery.	3.
Electrical Engin'g (3) Designing and Drawing.	3.	Electrical Engin'g (3) Designing and Drawing.	3.	Electrical Engin'g (3) Designing and Drawing.	5.
Electrical Engin'g (4) Laboratory.	5.	Electrical Engin'g (4) Laboratory.	5.	Electrical Engin'g (4) Laboratory.	5.
Mechan'l Engin'g (8) Thermodynamics.	5.	Mechan'l Engin'g (9) Prime Movers.	5.	Mechan'l Engin'g(10) Machinery.	5.

THESIS.

As a requisite for graduation each student must present an acceptable thesis embodying the results of a special study. The subject of such study must lie within the field of Electrical Engineering, and must be announced to the President of the University (dependent upon the written approval of the professor in charge) not later than the beginning of the second term of the Senior year. The completed thesis must be submitted not later than the second Saturday before Commencement Day.

Department of Industrial Arts.

Hayes Hall. This large building of pressed brick and brown sandstone was recently completed and equipped at a cost of about $70,000. It is devoted to instruction in Industrial Arts. The entire front of the building is one hundred and sixty-eight feet and the depth one hundred and forty-six feet, with two rear wings of one story thirty-six by forty-nine feet. The central portion is three stories high and the front wings, two stories each. On the first floor is a reading room, an office, and two recitation rooms, besides the machine shop, the forge shop, and the foundry. On the second floor are the carpenter and pattern shops and six large recitation rooms with private rooms annexed.

The larger part of Hayes Hall is devoted to shop purposes, where instruction is given in the principles and practical details of the various branches of industry. The carpenter shop is equipped with twenty-five benches with full sets of tools for each, besides a large number of special tools; and in the pattern shop there are twenty pattern makers' lathes with the necessary turning and pattern makers' tools, besides a double revolving circular saw, a scroll saw, a hand planer, a trimmer, and a power grindstone. There are, in the forge shop, twenty-one stationary forges, with anvils and tools, one portable hand forge, a blacksmith's drill, and a punch shear and bar cutter. The blast for the forges is furnished by a power fan and the smoke is removed by an exhaust fan, both of which are driven by an electric motor. The foundry contains a cupola, a brass furnace and blowers, a moulding floor with sand flasks, ladles, etc. The machine shop, which is driven by a twenty-five horse-power electric motor, is equipped with the following: twenty-eight benches and complete sets of tools for vise work, seven speed lathes, fifteen engine lathes, two upright drills, a planer, a shaper, a milling machine, grinding machines for grinding both plane and cylindrical surfaces, tool grinders, emery wheels, etc. All of this machinery is furnished with full sets of tools, making the equipment as complete as possible.

COURSE IN INDUSTRIAL ARTS.

The primary object of this Course is to provide facilities for training those who wish to become teachers of manual training. The Course is also designed for those who purpose entering the various branches of manufacture and industry, not as engineers, but as practical managers, superintendents, or business men. The plan of the Course is to combine with a general science training, a large amount of drawing and shop work, in which the underlying principles and methods employed in the various branches of industry are dwelt on. The aim is educational as well as professional — the training of the mind as well as the hand. Considerable liberty of election is permitted, and by a proper choice of the elective studies offered, the student may obtain a training which will open the way to a wide range or occupations.

Note. — The figure in parenthesis following the name of a study indicates the number of the course in that subject, a full description of which will be found under that name and number in the "Course of Instruction."

FRESHMAN YEAR.

REQUIRED.

First Term.	Hours per week.	Second Term.	Hours per week.	Third Term.	Hours per week.
Drawing (1) Freehand.	1.	Drawing (1) Freehand.	1.	Drawing (1) Freehand.	1.
Drawing (8) Mechanical.	2.	Drawing (8) Mechanical.	2.	Drawing (8) Mechanical.	2.
English (1) Practical Rhetoric.	2.	English (1) Practical Rhetoric.	2.	English (1) Practical Rhetoric.	2.
Mathematics (6) Trigonometry.	5.	Mathematics (6) Trigonometry and Algebra.	5.	Mathematics (6) Analytical Geometry.	5.
Shopwork (1) Carpentry.	3.	Shopwork (1) Pattern Making.	3.	Shopwork (1) Pattern Making.	3.
Military Drill.		Military Drill.		Military Drill.	
		Tactics,	2.		

ELECTIVE.

At least four hours for the year chosen from the following subjects. If the student elects French or German, he must pursue it for two years:

First Term.	Hours per week.	Second Term.	Hours per week.	Third Term.	Hours per week.
Botany (2) Systematic.	2.	Gen'l Chem. (1) Non-metals & metals.	4.	French (1) Elementary.	5.
Agr'l Chem. (1) Principles.	5.	and		German (1) Elementary.	5.
and		Gen'l Chem. (2) Carbon Compounds.		Zoology (1) Systematic.	3.
Agr'l Chem. (3) Analytical.		and			
and		Metallurgy (1) Mineralogy.			
Agr'l Chem. Special.					

SOPHOMORE YEAR.

REQUIRED.

First Term.	Hours per week.	Second Term.	Hours. per week.	Third Term.	Hours. per week.
Drawing (9) Mechanical.	3.	Drawing (9) Mechanical.	3.	Drawing (9) Mechanical.	3.
English (3) Advanced Rhetoric.	2.	English (3) Advanced Rhetoric.	2.	English (3) Advanced Rhetoric.	2.
Physics (2) Mechanics and Heat.	3.	Physics (2) Electricity.	3.	Physics (2) Sound and Light.	3.
Shopwork (2) Forging.	3.	Shopwork (2) Forging.	3.	Shopwork (2) Forging.	3.
Military Drill.		Military Drill.		Military Drill.	
		Art of War,	2.		

ELECTIVE.

Seven hours a week for the year, chosen from any of the following subjects that the student is prepared to enter. But if one of the courses in Chemistry has not been elected to the Freshman year, it must be taken this year; and if French or German has been elected in the Freshman year, it must be continued through this year.

FIRST TERM.	Hours per week.	SECOND TERM.	Hours per week.	THIRD TERM.	Hours per week.
Agr'l Chemistry (3) Laboratory.	5.	French (3) Scientific.	2.	Physics (3) Advanced.	2.
Drawing (1) or (3) Freehand or Mechanical.	4.	German (2) Scientific.	2.	Physiology (1) Anatomy and Physiology.	3.
English (8) Literature.	2.	Mathematics (7) Calculus.	5.		

Or any of the elective studies of the preceding year which have not already been taken.

JUNIOR AND SENIOR YEARS.

During the Junior and Senior years Shop Work and Drawing will be required, together with Mechanism, Mechanics, Physical Laboratory, Constitutional History, Political Economy and Philosophy. Work may be elected also from the following subjects: Mathematics, Physical Laboratory, Chemical Laboratory, History, English, Philosophy, Freehand Drawing and Water Colors, Wood Carving and Clay Modeling, and the elective studies of the preceding years not already taken.

Department of Clayworking and Ceramics.

The University is the first, and at this time, the only institution of the United States offering special facilities for the study of clays, clayworking, and the chemical technology of the ceramic art. The facilities of the Department comprise: 1st. A convenient chemical laboratory, specially designed and equipped for the analysis and decomposition of silicates. Provision has been made for the use of hydrofluoric acid with safety and the platinum ware has been made to order with this purpose in view. 2d. A complete mechanical outfit for the preparation of clays for pottery manufacture and the production of the ware itself, or any grade from earthen wares to porcelain. The machinery is of the latest types and comprises all important varieties in use for grinding, tempering, washing, filtering and moulding. 3d. A similar plant for the manufacture of brick, tiles, pipes and hollow goods. The machinery here is of full size and samples up to a ton in weight, can be received and transformed into the finished articles by any or all of the standard methods in commercial use. The power for this purpose is derived from a fine electric motor, driven from the University power plant. 4th. A kiln house, equipped with a kiln in which several hundred bricks, or an equivalent quantity of sewerpipe, stoneware or pottery can be burnt. The fuel is intended to be coke, except in special cases, where the fuel available for burning clay wares is to be made the subject of test. There is also provided a crucible melting furnace, a muffle furnace for testing glazes, etc., a recuperative pottery furnace for burning in decorations and a regenerative furnace for testing fire-brick and refractory mixtures. These furnaces are fired with gasoline gas and air blast. 5th. A ceramic museum containing a fine collection of American pottery and clay products of every class, is in process of installation. 6th. A library of the best literature on the subject, mainly German, but containing a few English and French works, and the trade periodicals.

The greater part of the basement of Orton Hall is occupied as a laboratory by the Department of Clayworking and Ceramics. This Department is also accommodated with a large room on the first floor for recitation and exhibition purposes. In the rear of Orton Hall is a small brick structure, used for the kilns of the Departments of Clayworking and Ceramics.

COURSE IN CLAYWORKING AND CERAMICS.

This Course has been provided in response to the urgent appeals to the Legislature on the part of representatives of various clay industries of the State. The Course is designed to give to those who are engaged or who expect to be engaged in the manufacture of clay products an opportunity to learn in the shortest time possible, the rudiments of the sciences which are most likely to be useful to them in their work.

Chemical work is made the main feature of the Course. It is supplemented by elementary physics, geology, and mathematics. The Ceramic Laboratory work in the second year of the Course will teach students to apply the knowledge gained from their studies before leaving college, and will thus open the way toward the creation of a class of trained observers in the practical problems of the industry, which will be of the greatest value to the improvement and progress of the art.

NOTE.—The figure in parenthesis following the name of a study indicates the number of the course in that subject, a full description of which will be found under that name and number in the "Course of Instruction."

FIRST YEAR.

FIRST TERM.	Hours per week.	SECOND TERM.	Hours per week.	THIRD TERM.	Hours per week.
Physics (1) Elementary.	5.	Physics (1) Elementary.	5.	Geology (1) Physical Geography.	5.
Metallurgy (9) Mineral Chemistry.	5.	Ceramics (1) General Principles.	5.	Metallurgy (5) Laboratory.	5.
Mathematics (2) Algebra.	5.	Mathematics (4) Geometry.	5.	Shopwork,	5.
Military Drill.		Military Drill.		Military Drill.	

SECOND YEAR.

FIRST TERM.	Hours per week.	SECOND TERM.	Hours per week.	THIRD TERM.	Hours per week.
Ceramics (2) Analysis of Clays.	5.	Ceramics (2) Analysis of Pottery and Glass.	5.	Ceramics (2) Analysis of Glazes and Enamels.	5.
Ceramics (3) Principles of Clay-working.	5.	Ceramics (3) Manufacture of Brick.	5.	Ceramics (3) Manufacture of Pottery.	5.
Geology (2) General.	5.	Geology (3) Economic.	5.	Drawing (11) Mechanical.	5.
Military Drill.		Military Drill.		Military Drill.	

Courses of Instruction.

AGRICULTURAL CHEMISTRY.

CHEMICAL HALL.

1. Agricultural Chemistry.

First Term.— Five times a week. Principles of Chemistry and Chemical Nomenclature. Lectures and Text-book for three or four weeks, M, Tu, W, Th, F, at 9¼. For remainder of term, Chemistry of Non-metals, twice a week, Tu, Th, at 9¼. Laboratory Practice, Qualitative Analysis, three times a week. Laboratory open M, Tu, W, Th, F, 8¼ to 4½.

Professor Weber.

Required in the Freshman year of the Course in Mining Engineering.

3. Analytical Chemistry.

Second Term.— Five times a week. Laboratory Practice. Laboratory open M, Tu, W, Th, F, 8¼ to 4½.

Professor Weber.

Required in the Freshman year of the Course in Mining Engineering.

ASTRONOMY.

THE EMERSON MCMILLIN OBSERVATORY.

2. Astronomy and Geodesy.—Lectures and Field Practice.

Third Term.— Four times a week. M, Tu, W, Th, at 11½. Lectures on the determination of Time, Latitude, Longitude and Azimuth. The student is required to determine each co-ordinate from his own observations.

First Term.— Three times a week. M, W, F, 11½. Lectures on Geodetic Surveying supplemented with actual practice in the field, including base line measurement, observation of the angles of a triangulation net, and the determination of the astronomical co-ordinates.

Second Term.— Twice a week. Tu, Th, at 11½. The observations of the preceding term are reduced and discussed by the method of Least Squares; the most probable value of the angles and sides determined and the Latitudes, Longitudes and Back Azimuths are computed by the method of the United States Coast and Geodetic Survey.

Books of reference: Doolittle, Chauvenet, and the reports of the Coast Survey.

Assistant Professor Lord.

The third term is required in the Junior year of the Course in Civil Engineering, and the first and second terms are required in the Senior year of the Course in Civil Engineering.

BOTANY.

BOTANICAL HALL.

The general Botanical Laboratory occupies a part of the second floor of Botanical Hall. It is 23 x 33 feet and is furnished with both movable and fixed tables. The latter are attached to the west and south walls near windows suitably shaded. Water, gas, and an evaporating hood are also provided. The Laboratory is equipped with compound microscopes of the Baush and Lomb, the Leitz and other patterns, and accompanying each is a tray of tools and a case of reagents. There are more than thirty dissecting microscopes; also charts, and several minor pieces of apparatus for experiments in vegetable physiology. Three smaller rooms are also provided as laboratories for special work, as well as a dark room for photography. Other facilities for the illustration of the courses in botany, and for practical training the same, are a general herbarium including flowering plants, ferns, mosses, fungi and algae; a state herbarium, a collection of fruits and seeds, valuable timbers, woods, grasses, and various economic products of the vegetable kingdom; oramental grounds and woodland, planted with a large variety of evergreen and deciduous trees and shrubs; and a greenhouse with a fair collection of native and exotic plants.

2. General Botany.— Lectures and Field Work.

FIRST TERM.— Three times a week. Systematic Botany and Vegetable Physiology. Tu, Th, at 9¼, F, at 10¼.

SECOND TERM.— Twice a week. Cryptogamic Botany. Tu, Th, at 9¼.

Books of Reference: Gray's Revised Manual, Bennett and Murray's Cryptogamic Botany, Bessey's Botany, Kellerman's Elements.

Professor KELLERMAN.

Elective in the Course in Industrial Arts.

CIVIL ENGINEERING.

UNIVERSITY HALL.

1. Land Surveying.—Recitation and Field Work. M, Tu, W, Th, F, 1½ to 4½.

FIRST TERM.—Six times a week. Johnson's Theory and Practice of Surveying.

Mr. KEMMLER.

Required in the Sophomore year of the Course in Civil Engineering.

2. Railroad Surveying.—Recitations and Field Work. M, Tu, W, Th, F, 1½ to 4½.

THIRD TERM.—Six times a week. Searle's Field Engineering.

Mr. KEMMLER.

Required in the Sophomore year of the Course in Civil Engineering.

3. Topographical Surveying.— Lectures, Tu, Th, F, at 10½. Field Work and Drawing, M, Tu, W, Th, F, 1½ to 4½.

First Term.—Four times a week. Johnson's Surveying used for reference.
Mr. Kemmler.

Required in the Junior year of the Course in Civil Engineering.

4. Technical Drawing—Platting, Pen and Colored Topography. Tu, W, Th, 1½ to 4½.

Second Term.—Four times a week.
Professor Brown.

Required in the Junior year of the Course in Civil Engineering.

5. Technical Drawing.—Working Drawings and Blue-Printing.

Second Term.—Three times a week. M, Tu, 1½ to 4½.
Mr. Kemmler.

Required in the Junior year of the Course in Civil Engineering.

6. Stereotomy—Recitations, Drawing and Model Cutting. M, Tu, W, Th, at 11½.

Second Term.—Four times a week. Warren's Stereotomy.
Mr. Kemmler.

Required in the Junior year of the Course in Civil Engineering.

7. Bridge Strains.—M, Tu, W, Th, F, at 1½.

Third Term.—Five times a week. The class is divided into two sections— The students in Civil Engineering (Section A) have recitations and use Du Bois's Strains in Framed Structures as a text-book. The students in Mining and Mechanical Engineering (Section B) have recitations, lectures, and drawing. The work is modified to meet the special needs of these students and includes the elements of designing.
Professor Brown, Mr. Kemmler.

Required in the Junior year of the Courses in Civil, Mining, and Mechanical Engineering.

8. Bridge Designing—Lectures and Drawing. M, Tu, W, Th, F, at 10¼.

First Term.— Five times a week. Part II. of Du Bois's Strains in Framed Structures, used for reference.
Professor Brown.

Required in the Senior year of the Course in Civil Engineering.

9. Civil Engineering—Recitations and Lectures. M, Tu, W, Th, F, at 8¼.

First Term.— Five times a week. Baker's Masonry Construction.

Second Term.— Five times a week. Section A. Lectures on Highways, Municipal Engineering, River and Sea Coast Improvements, Canals, Railways, and Irrigation. Section B. Recitations and Lectures on Railway Location, using Wellington's Economic Theory of Railway Location as a text-book. Students may elect between the two sections.

Third Term.— Five times a week. Fanning's Water Supply.
Professor Brown.

Required in the Senior year of the Course in Civil Engineering.

10. Sanitary Engineering — Lectures. M, Tu, W, Th, F, at 9¼.

Third Term.—Five times a week. Professor Brown.

Required in the Senior year of the Course in Civil Engineering.

14. Civil Engineering.—Laboratory.

Second Term.— Two times a week. The work consists principally of cement testing and adjustment of engineering instruments.

Professor Brown.

Required in the Senior year in the Course in Civil Engineering.

CLAY WORKING AND CERAMICS.

ORTON HALL.

1. Elementary Chemistry — Lectures and Laboratory work. M, Tu, W, Th, F, at 9¼.

Five times a week.—Continuing the work begun in Metallurgy 9 and completing qualitative analysis of the bases.

Professor Orton, Jr.

Required in the second term of the first year of the Course in Clay Working and Ceramics.

2. Advanced Chemistry— Laboratory Work. M, Tu, W, Th, F, at 8¼.

First Term.—Five times a week. Analysis of clays, felspars and cements.

Second Term.— Five times a week. Analysis of pottery bodies.

Third Term. — Five times a week. Analysis of glazes, enamels and ceramic colors. Professor Orton, Jr.

Required in the Second year of the Course in Clay Working and Ceramics.

3. Ceramic Laboratory.— M, Tu, W, Th, F, at 1½.

First Term.— Lectures twice a week and Laboratory work three times a week, covering the origin and properties of clays, chemical and mineralogical composition, mechanical analysis and methods of testing physical qualities of clays.

Second Term.— Lectures and Laboratory as before covering the compounding of clay mixtures or bodies for bricks, refractory material or pottery.

Third Term.—Lectures and Laboratory as before, covering the compounding of glazes, enamels and ceramic colors. Practical experiments are required, involving the successful production and application of this class of bodies. Professor Orton, Jr.

Required in the Second year of the course in Clay Working and Ceramics.

DRAWING.

HAYES HALL.

The Department occupies the entire third floor of Hayes Hall and is provided with the following equipment for the illustration of the work in drawing and for practical training in the same. For freehand drawing; flat and shaded copies in pencil and charcoal; wooden models of geometric forms; plaster casts of ornaments, flowers, fruit and the antique; easels and drawing tables for pen and ink drawing and for water-color and oil painting; a well selected line of work from artists of recognized ability. For mechanical drawing: C. S. U. improved drawing tables (30″ x 36″ tops), a set of the celebrated Schroeder models, a collection of shop drawings and facilities for blue printing. For photography: a well arranged and equipped dark room, printing outfits, copying camera, four view cameras, lenses of long and short focus, flash lamp and a shutter for instantaneous photography. In addition to the above, the library contains a well chosen collection of books pertaining to the work of the Department.

1. Freehand Drawing.— Outline Drawing from Copy and Wooden Models.

Charcoal and crayon and pen drawing from copy and plaster casts.

Three Terms.— Once a week. Two hours' drawing. 9¼ to 11¼, Sec. I, M; Sec. II, Tu; Sec. III, W; Sec. IV, Th; Sec. V, F. 1½ to 3½, Sec. VI, M; Sec. VII, W; Sec. VIII, F. Mr. Taylor, Mr. Lewis.

Required in the Freshman year of the Industrial Arts Course; the first and second terms of the Freshman year of the Courses in Engineering, the first term of the second year of the Short Mining Course.

2. Lettering.— Lectures and Practice. M, Tu, W, Th, F, 1½ to 4½.

Third Term.— Twice a week (four hours' practice) in the Civil and Mining Engineering Courses. Three times a week (six hours' practice) in the Mechanical and Electrical Engineering Courses. In the Mechanical and Electrical Engineering Courses projection drawing is commenced. *Lectures* — Care and manipulation of draughting instruments; proper construction of letters; proper construction of titles; principles of projection. *Practice* — Drawing a series of progressive plates.
Associate Professor Bradford, Mr. French.

Required in the Freshman year of the Courses in Engineering and in the second year of the Short Mining Course.

3. Mechanical Drawing.— Lectures, Recitations and Practice. Lecture, Sec. I, Tu at 10¼, Sec. II, F at 10¼. Drawing, Tu, Th, 9¼ to 11¼; M, Tu, W, Th, F, 1½ to 4½.

First Term.— Three times a week in the Civil and Mining Engineering Courses. Text-book: Faunce's Mechanical Drawing. One hour lecture and recitation. Four hours' practice in drawing a series of progressive plates. Four times a week in the Mechanical and Electrical Engineering Courses. Text-book: Faunce's Mechanical Drawing and Descriptive Geometry. One hour lecture and recitation. Six hours' practice in drawing a series of progressive plates.

Second Term.— Five times a week in Civil Engineering Course. Three times a week in the Mining Engineering and Industrial Arts Course. Twice a week in the Mechanical and Electrical Engineering Courses. Text-book: Church's Descriptive Geometry and Shades, Shadows and Perspective. From four to six hours' practice in drawing a series of progressive plates.

Third Term.— Three times a week. Text-book: Church's Shades, Shadows and Perspective. One hour lecture and recitation. Four hours' practice in drawing plates, using the technical colors to represent different materials.
Associate Professor Bradford, Mr. French.

Required in the Sophomore year of the Engineering and Industrial Arts Courses and in the first term, second year, of the Short Mining Course.

4. Draughting and Blue Printing.— Lectures and Practice. Tu, Th, 1½ to 4½.

SECOND TERM.— Three times a week (six hours' drawing).
Associate Professor **BRADFORD.**

Required in the Second year of the Short Mining Course.

5. Technical Drawing — Lectures and Practice. Th, F, 1½ to 4½.

FIRST TERM.—Three times a week. Lectures on rules and methods for detail drawing, tracing, blue-printing, machine designing, and practice in making same favorably to present the form, dimensions, etc., to the workman in practice. Line shading of drawings.
Associate Professor **BRADFORD.**

Required in the Junior year of the Courses in Mechanical and Electrical Engineering.

7. Photography — Lectures and Practice.

FIRST TERM.—Twice a week, M, Tu, 1½ to 4½ (four hours' practice). *Lectures.*— Optics of photography; chemistry of photography; exposing and developing; printing; orthocromatic photography; lantern slides; applications of photography. *Practice* — Out-door photography; interior photography; flash-light photography; copying; lantern slides; printing; instantaneous photography; applications.

THIRD TERM.— Same work as first term. Th, 1½ to 4½.
Associate Professor **BRADFORD.**

Required in the Senior year, first term, of the Course in Mining Engineering, in the third term, Senior year, of the Course in Mechanical Engineering, and in the third term, Junior year, of the Course in Civil Engineering.

8. Mechanical Drawing — Lectures and Practice. Tu, Th, 1½ to 3½.

THREE TERMS.—Twice a week (four hours' practice). *Lectures* — Instruments and materials. Construction of letters and titles and principles of projection. *Practice* — Drawing a series of progressive plates in geometric drawing, lettering, and elementary projection drawing.
Associate Professor **BRADFORD**, Mr. **FRENCH.**

Required in the Freshman year of the Industrial Arts Course.

9. Mechanical Drawing — Lectures and Practice.

THREE TERMS.—Three times a week. One hour lecture and recitation. Four hours' practice. M, W, F, 1½ to 3½.

Required in the Sophomore year of the Industrial Arts Course.
Associate Professor **BRADFORD**, Mr. **FRENCH.**

11. Mechanical Drawing — Lectures and Practice.

THIRD TERM. — Five times a week. One hour lecture. Eight hours' practice. M, Tu, W, Th, F, 1½ to 3½.

Required in the second year of the Course in Clay-working and Ceramics.
Associate Professor **BRADFORD.**

ENGLISH AND RHETORIC.

Hayes Hall.

I. Rhetoric.

1. Practical Rhetoric — Recitations and Prescribed Readings. Twice a week through the year.

Text-books: Scott and Denney's Paragraph-Writing, Genung's Practical Rhetoric. Essays. Sec. I, M, W, at 3½; Sec. II, Tu, Th, at 9¼; Sec. III, Tu, Th, at 2½; Sec. IV, Tu, Th, at 3½; Sec. V, hours to be arranged.

Professor Denney, Mr. Taylor.

Required in the Freshman year of all four-year Courses.

3. Advanced Rhetoric.—Lectures, Recitations and Prescribed Readings. Twice a week through the year. M, W, at 10¼.

First Term.—Principles of Style. A study of the characteristics of writings on technical subjects. Text-book: Genung's Rhetorical Analysis. Reports on the engineering magazines. Essays.

Second Term.—Principles of Construction. A study of logical structure. Reports on engineering magazines. Essays.

Third Term.—Principles of presentation. A study of the method of presenting technical subjects. Reports on the engineering magazines. Essays.

Professor Denney.

Required of Juniors in Civil Engineering, and of Sophomores in all other Courses in Engineering.

III. English Literature.

8. A General Survey of English Literature from the time of Chaucer — Recitations, Reports, and Lectures. Twice a week through the year. Tu, Th; Sec. I at 9¼; Sec. II at 3½.

Professor Barrows.

Elective in the Course in Industrial Arts.

FRENCH.

UNIVERSITY HALL.

1. Elementary French — Recitations. Five times a week. M, T, W, Th, F. Sec. I at 8¼; Sec. II at 10½; Sec. III at 1½.

First Term.— Grammar; Whitney's Practical (Part I) or Joynes' Minimum Written Exercises. Reader: Whitney's (Parts I and II) or Super's (from Part II).

Second Term.— Grammar and Reader finished. Erckmann-Chatrian; Waterloo (Super), or Thiers; Expedition de Bonaparte en Egypte (Edgren).

Third Term.— Halévy; L'Abbé Constantin (Logie), or Mérimée; Colomba; Sandeau: Mademoiselle de la Seiglière (Warren). Sight Reading.

Professor Bowen, Mr. Watson.

Required in the Freshman year of the Courses in Engineering.

3. Scientific Reading — Recitations. Twice a week. Tu, Th, at 9¼.

FIRST TERM.— Luquiens's Popular Science.

SECOND TERM.— Same.

THIRD TERM.— Tissandier, Les Fossiles or La Houille.

Mr. **WATSON.**

Required in the Sophomore year of the Courses in Civil, Mining, and Mechanical Engineering for students who have taken course 1. Optional voluntary in the Sophomore year of the Course in Electrical Engineering.

GENERAL CHEMISTRY.

CHEMICAL HALL.

The laboratories of the Department accommodate two hundred and ten students. The general lecture room is large and well lighted, and all needed facilities are provided for the full experimental illustration of the lecture courses. The Department is generously supplied with the best apparatus and materials for both lecture and laboratory work, and has also a growing collection of specimens illustrating the application of chemistry to the arts.

1. Elementary Chemistry — Lectures and Recitations.

FIRST TERM.— Four times a week. Chemistry of the non-metals. Norton's Chemistry. M, Tu, W, Th, at 10¼.

SECOND TERM.—Twice a week. Chemistry of the metals. Norton's Chemistry. Tu, Th, at 10¼. Professor **NORTON.**

Required in the Freshman year of the Courses in Civil, Mechanical and Electrical Engineering.

1*a*. Elementary Chemistry — Laboratory.

SECOND TERM.—Three times a week. Mr. **RITCHEY.**

Required in the Freshman year of the Courses in Civil, Mechanical, and Electrical Engineering.

2. Elementary Chemistry — Lectures and Recitations.

THIRD TERM.— Four times a week. M, Tu, W, Th, at 10¼. Chemistry of the carbon compounds. Professor **NORTON.**

Elective in the Course in Industrial Arts.

GEOLOGY.

ORTON HALL.

The University is able to present unusual advantages for the study of geology. By an act of the legislature it has been put in possession of all the collections made by the late geological survey, and these collections have been supplemented by valuable additions of fossils and minerals from various sources. The State collection embraces a very complete representation of every geological formation shown in Ohio. In its new and ample quarters the department offers exceptionally good opportunities for work in the lithological, petrographical, and modeling laboratories.

1. Physical Geography — Lectures and Recitations.

Third Term.— Five times a week. M, Tu, W, T, F, at 8¼. Geikie's Elementary Lessons, supplemented by lectures, map drawing, and the study of geographical models. Miss Bascom.

Required in the Short Course in Mining and the Course in Clay-working and Ceramics.

2. General Geology — Lectures. M, Tu, W, Th, F, at 9¼.

First Term.— Five times a week. Subjects: Cosmical Geology, Lithological Geology, Dynamical and Structural Geology. Books of reference used by students in preparation of their work: Green's Physical Geology, Geikie's Text-book of Geology, Le Conte's Elements of Geology, Hunt's Chemical Geology, Daubree's Geologie Experimentale, etc.

Second Term.— Five times a week. Subjects: Paleontological Geology, Historical Geology. Books of reference used by students in preparation of their work: Nicholson's Paleontology, Zittel's Paleontologie, Ohio Geological Reports, Paleontology of New York, etc. Professor Orton.

Required in the Senior year of the Course in Mining Engineering and in the Junior year of the Course in Civil Engineering. The first term is required in the second year of the Course in Clay-working and Ceramics.

3. Economic Geology — Lectures. M, Tu, W, Th, F, at 10¼.

Second Term.— Five times a week. Subjects: Economic materials of stratified rocks, clays, limes, cements, coals, iron, ores, etc., etc., phosphates, petroleum. 2. Economic materials derived from veins and igneous rocks, gold, silver, copper, mercury, etc., etc. Gems. Books of reference used by students in preparation of their work: Publications of U. S. Geological Survey, State Geological Surveys, Phillips' Ore Mining, etc. Professor Orton.

Required in the Senior year of the Courses in Civil and Mining Engineering, and in the second year of the Course in Clay-working and Ceramics.

4. Elementary Geology — Lectures and recitations. M, Tu, W, Th, F, at 11½.

Second Term.— Five times a week. Text-book: Le Conte's Class Book of Geology. Miss Bascom.

Required in the second year of the Short Mining Course.

4*a*. Dynamical and Structural Geology — Lectures. M, Tu, W, Th, F, at 2½.

Second Term.— Five times a week. rofessor Orton.

Required in the Senior year of the Course in Mechanical Engineering.

GERMAN.

UNIVERSITY HALL.

1. Elementary German.

Three Terms.— Five times a week. M, Tu, W, Th, F. Sec. I at 8¼; Sec. II at 1½; Sec. III at 2½.

Practical German Grammar, Thomas. Reading: Preparatory German Reader, Van Daell; Der Besuch im Carcer-Eckstein, ed. Maynard; Soll und Haben, Freitag, ed. Bultmann. Mr. Mesloh.

Required in the Freshman year of the Courses in Civil, Mining, Mechanical, and Electrical Engineering, and in the Course in Industrial Arts.

2. Scientific Reading.

Three Terms.—Twice a week. Tu, Th. Sec. I at 9¼; Sec. II at 3½.

Science Reader, Gore. Gesetze der Naturerscheinungen, Pinner. After these two general books are finished, the selections from books or periodicals will be adapted to the specialties of the students. This course is open to students who have had course 1.

Mr. Meslch.

Required in the Sophomore year of the Courses in Civil, Mining and Mechanical Engineering and Industrial Arts. Optional in the Course in Electrical Engineering.

MATHEMATICS.

HAYES HALL.

2. Algebra — Recitations. M, Tu, W, Th. F, at 10¼.

Three Terms. — Five times a week. Wentworth's Elements of Algebra, completed.

Assistant Professor Ray.

Required of students in the first year of the Short Course in Mining and the Course in Clayworking and Ceramics, and is a special class and course for such students only.

4. Geometry and Trigonometry — Recitations. Five times a week. M, Tu, W, Th, F, at 9¼.

First Term. — Plane Geometry. Venable's Geometry.

Second Term. — Solid Geometry. Venable's Geometry.

Third Term. — Plane Trigonometry. Lock's Elementary Trigonometry.

Mr. Arnold.

Required in the first year of the Short Course in Mining, and the Course in Clayworking and Ceramics.

6. Trigonometry, Higher Algebra, Analytical Geometry.— Lectures and Recitations. Five times a week through the year. M, Tu, W, Th, F. Sec. I and II at 9¼; Sec. III at 10¼; Sec. IV at 1½; Secs. V and VI at 2½.

First Term. — Trigonometry. Lock's Elementary Trigonometry; Lock's Higher Trigonometry.

Second Term. — Higher Algebra and Theory of Equations (Taylor's College Algebra), three times a week; Analytical and Spherical Trigonometry, twice a week (Lock's Higher Trigonometry, with notes on Spherical Trigonometry).

Third Term. — Analytical Geometry. Nichol's Analytical Geometry.

Professor Bohannan, Assistant Professor McCoard,
Ass't Professor Lord, Mr. Arnold, Mr. Swartzel.

Required in the Freshman year of the Courses in Engineering.

7. Analytical Geometry and Calculus.— Lectures and Recitations. Five times a week through the year. M, Tu, W, Th, F. Secs. I, II, and III, at 8¼.

First Term.—Analytical Geometry continued (Nichol's Analytical Geometry); Calculus begun (Greenhill's Calculus).

Second and Third Terms.— Calculus continued.

Professor Bohannan, Assistant Professor McCoard, Mr. Arnold.

Required in the Sophomore year of the Engineering Courses.

8. Least Squares.— Lectures and Recitations. Tu, Th, at 11½ or 10¼.

First Term.— Twice a week. Johnson's Theory of Errors and Least Squares.

Professor Bohannan.

Required in the Junior year of the Courses in Civil, Mechanical and Electrical Engineering.

11. Differential Equations.— Lectures. M, at 11½.

First Term.— Once a week. The special differential equations occuring in mechanical problems. Osborne's Examples.

Professor Bohannan.

Required in the Junior year of the Course in Mechanical Engineering.

MECHANICAL ENGINEERING.

MECHANICAL HALL.

2. Testing Laboratory.— M, Tu, W, Th, F, 9¼ to 12½.

(*a*) Three Terms.— From two to four times a week.

A course in exact metal work, including grinding and measuring as in producing accurate standard plugs and rings; oil testing, comprising determination of friction, endurance, density, drying quality and flashing point; calibration of steam engine indicator springs, steam gauges; indicator practice; testing materials of construction in tension, compression, flexure and impact; experiments in flow of fluids.

Required in the Junior year of the Course in Mechanical Engineering and portions of it in the Course in Electrical Engineering.

(*b*) Three Terms.— From three to five times a week. M, Tu, W, Th, F, 8¼ to 11½.

An advanced course in experimental engineering, comprising calibration and use of transmission dynamometers; belt testing; use of condensing, throttling and barrel calorimeters for steam; testing of eliminators, injectors and steam pipe coverings; the steam engine indicator and pony brake as applied to steam engines; valve and eccentric setting; efficiency tests of steam engines when used, condensing, non-condensing and compound; efficiency of boilers; testing of complete steam plants; flow of water through weirs, orifices and pipes; efficiency tests of hot air engines, pulsometer, steam pumps, hydraulic ram, centrifugal pump, impulse, and turbine water wheels.

Professor Robinson, Mr. Hitchcock.

Required in the Senior year of the Courses in Civil and Mechanical Engineering.

3. Mechanism.

First Term —Twice a week. Tu, Th, at 11½ or 1½.

Second Term.— Five times a week. Lectures on the Principles of Elementary Combinations of Mechanism. M, Tu, W, Th, F, at 11½ or 1½.

Third Term.— Four times a week. Accurate laying out of a movement, designing and constructing of same in material. Laboratory open M, Tu, W, Th, F, 8¼ to 11½. Professor Robinson, Mr. Hitchcock.

Required in the Junior year of the Course in Mechanical Engineering; the first and second terms required in the Course in Electrical Engineering.

4. Invention and designing.— M, W, F, at 1½ or 2½.

First Term.— Three times a week. Lectures on Machine Designs and Original Designing of Machine Parts, and on Invention of Machines, and a course of five or more original inventions, and parts fully designed and drawn ready for construction.

Professor Robinson, Mr. Hitchcock.

Required in the Senior year of the Course in Mechanical Engineering.

5. Engine Designing.— M, Tu, W, Th, F, at 2½.

Third Term.— Five times a week. A course of Invention, Designing, Detailing and Drawing, as in office work practice. A subject is chosen which involves the necessity of calculations as based on most of the principles previously taught in the course.

Professor Robinson, Mr. Hitchcock.

Required in the Senior year of the Course in Mechanical Engineering.

6. Analytical Mechanics—M, Tu, W, Th, F. Sec. I at 8¼ ; Sec II at 10¼.

First and Second Terms.—Five times a week. Lectures accompanied by Bower's Mechanics, including statics and kinetics.

Professor Robinson.

Required in the Junior year of the Courses in Engineering.

7. Strength of Materials—M, Tu, W, Th, F. Sec. I, at 8¼ ; Sec. II, at 10¼.

Third Term.— Five times a week. 1. Lectures and text-book on elastic resistance to tension, compression, flexure, torsion. 2. Lectures and text-book on ultimate resistance to rupture by tension, compression flexure, torsion. 3. Lectures on allowed maximum-stress in structures, and the various modes of determining it, including factory for safety, absolute modulus of safety, rational limit of safety, and Wohler's Laws. 4. Two weeks of the term. Lectures on hydraulics ; on flow of water through orifices, weirs, pipes, streams, and the guaging of streams. Adaptation of formulas to flow of gases at constant density.

Professor Robinson.

Required in the Junior year of the Courses in Engineering.

8. Thermodynamics—M, Tu, W, Th, F, at 11½.

First Term.— Five times a week. Lectures on the action of heat. General equations, isothermal, adiabatic, and isodiabatic lines. Indicator diagrames of perfect engines, Rankine and Wood's Thermodynamics serves as accompaniment. Flow of gases through pipes and orifices under various laws of varying density. Professor Robinson.

Required in the Senior year of the Mechanical Engineering and Electrical Engineering Courses.

9. Prime Movers— M, Tu, W, Th, F, at 11½.

SECOND TERM.—Five times a week.

1st. Lecture on heat engines, including hot air, steam and gas engines.

2d. Water motors, including impulse wheels, turbines, breast and overshot wheels, water engines, wind wheels. Rankine's Prime Movers and Wood's Thermodynomics in accompaniment.

3d. Lectures on valve gears, shaft and fly ball, governors, fly wheels, and fluctuation of speed, counterbalancing, quiet running and economy of engines. Professor ROBINSON.

Required in the Mechanical and Electrical Engineering Courses.

10. Machinery and Millwork—M, Tu, W, Th, F, at 11½.

THIRD TERM.—Five times a week. Lectures on efficiency of elimentary combinations of machinery, strength, endurance, friction, shock, adaptation of materials, fly wheels for machines, transmission of power and machinery for the same. Rankine's Machinery and Millwork in accompaniment.

Professor ROBINSON.

Required in Mechanical and Electrical Engineering Courses.

11. Technical Drawing — Machine Designing and Drawing. Lectures and Practice. M, W, F, 9¼ to 11¼. Th, 1½ to 4½.

THIRD TERM.—Five times a week (ten hours practice). Lectures on machine designing. Practice. Designing machine parts, and drawing and blue-printing them ready for construction. Showing form and dimensions. Professor WILLISTON.

Required in the Junior year of the Courses in Mechanical and Electrical Engineering.

METALLURGY.

CHEMICAL HALL.

1. Mineralogy.— Lectures. M, W, F, at 9¼.

SECOND TERM. — Three times a week. With references to Dana's Manual of Mineralogy and Lithology as a text-book. Students required to keep notes, and to study specimens in the collection of minerals. A short introductory course is given on crystallography, illustrated by wooden models. Professor LORD.

Elective in the Course in Industrial Arts.

2. Mineralogy — Lectures. M, W, F, at 9¼.

THIRD TERM.—Three times a week. Similar to course 1, above, but more practical, and arranged so as to be preparatory to determinative minerology (course 3). Professor LORD.

Required in the Freshman year of the Courses in Civil and Mining Engineering.

3. Determinative Mineralogy.

Third Term.—Three times a week. Laboratory course in practical determination of minerals by physical and chemical tests. Brush's Determinative Mineralogy is used as a manual. Each student is furnished with a set of apparatus, and works under the instructor's inspection. Laboratory open M, Tu, W, Th, F, 8¼ to 4½.

Professor **Lord**.

Required in the Junior year of the Course in Mining Engineering.

4. Metallurgy — Lectures. M, Tu, W, Th, F, at 1½.

First and Second Terms.— Five times a week. A course of lectures upon fuel and its uses, iron and steel, copper, lead, gold, and silver, their properties, tests, ores, and details of the modes of reduction. Students are required to take notes and also to study references to standard works and journals. Professor **Lord**.

Required in the Junior year of the Course in Mining Engineering, and in the Senior year of the Course in Mechanical Engineering.

5. Metallurgical Laboratory — Lectures and Laboratory Work.

Three Terms.— Laboratory practice in the analysis of iron and steel, iron ores, fuels, clays, etc., by the most approved methods as practiced in the technical laboratories of metallurgical works. Laboratory open M, Tu, W, Th, F, 8¼ to 4½.

Professor **Lord**.

Required in the Sophomore year of the Course in Mining Engineering, and the third term of the first year of the Course in Clayworking and Ceramics.

Course 5 must be preceded by Agricultural Chemistry, courses 1 and 3, or by General Chemistry, course 3.

6. Assaying.— Laboratory Work.

Second Term.— Work in the assaying of gold, silver and lead ores by furnace methods. Oral instruction, with reference to standard books on assaying. Laboratory open M, Tu, W, Th, F, 8¼ to 4½.

Professor **Lord**.

Required in the Junior year of the Course in Mining Engineering.

7. Metallurgical Construction.— M, W, F, at 2½.

First Term.— Three hours a week. Practice in the designing of furnaces and other metallurgical machinery, including detail drawings and estimates.

Assistant Professor **Ray**.

Required in the Senior year of the Course in Mining Engineering.

8. Ore Dressing.— Lectures. M, Tu, W, Th, F, at 1½.

Third Term.— Five times a week. Instruction in the methods of concentrating and enriching ores by mechanical means. Lectures with reference to Rittinger's Auf Bereitung, Callon's Cours d' Exploitation des Mines, Kunhardt's Ore Dressing, and various papers in technical journals. Professor **Lord**.

Required in Senior year of the Course in Mining Engineering.

9. Mineral Chemistry.— Lectures and Laboratory Practice.

First Term. — Five hours a week. M, Tu, W, Th, F, at 9¼. A brief course in elementary chemistry taught partly by lectures and partly by laboratory practice of a simple character.

Second Term. — Two hours a week. Tu, Th, at 9¼.

Third Term.— Five hours a week. M, Tu, W, Th, F, at 8¼. The second and third terms are devoted to lectures upon fire-damp, mine explosions, explosives, boiler waters, poisonous gases, iron ores, iron and steel, their properties and modes of manufacture, coal and coke, etc,

Professor Lord.

Required in the second year of the Short Course in Mining, and in the first term of the first year of the Course in Clayworking and Ceramics.

10. Plans and Specifications.— M, Tu, W, Th, F, at 10¼ or 11½.

Third Term.— Five hours a week. Each student is required to make plans, drawings and estimates for some special metallurgical or mining plant assigned him by the Professor in charge. He also makes a report upon the process involved, and an estimate of the probable cost of products, etc.

Professor Lord, Assistant Professor Ray.

Required in the Senior year of the Course in Mining Engineering.

MINE ENGINEERING.

CHEMICAL HALL.

1. Mine Surveying.— Lectures and Field Practice. M, Tu, W, Th, F, at 1½.

First Term.— Five hours a week. This is similar to course 4, but more elementary. The same book is used. The students have more practice in the drawing room.

Assistant Professor Ray.

Required in the second year of the Short Course in Mining.

2. Ventilation and Haulage.— M, Tu, W, Th, F, at 1½.

Second Term.— Five hours a week. Lectures are of an elementary character, illustrated by experiments and maps of mines and models when possible, tests by safety lamps and anemometers, and solution of problems of an air distribution in coal mines.

Assistant Professor Ray.

Required in the second year of the Short Course in Mining.

3. Mine Operating.— M, Th, W, Th, F, at 1½.

Third Term.— Five hours a week. A course of lectures and practical instruction in mine book-keeping and accounts, cost of working, etc., particularly adapted to Ohio coal mining.

Assistant Professor Ray.

Required in the second year of the Short Course in Mining.

4. Mine Surveying.— M, Tu, W, Th, F, at 2½.

First Term.— Five hours a week. Field practice in the use of instruments for surface and underground surveys. Full notes are taken, and maps and plans made in the drawing room. Davie's Surveying, by Van Amringe, is used as a text-book. Assistant Professor Ray.

Required in the Junior year of the Course in Mining Engineering.

5. Mining Engineering.— Lectures. M, Tu, W, Th, F, at 8¼.

Three Terms.— Five hours a week. Mine operating, mining machinery, ventilation, shaft-sinking, working out deposits, etc. Constant reference is required to the standard works and to the leading technical journals, with practice in designing mine plants, draughting, and estimates. Assistant Professor Ray.

Required in the Senior year of the Course in Mining Engineering.

MILITARY SCIENCE AND TACTICS.

UNIVERSITY HALL.

1. Military Drill — Five times a week through the year. M, Tu, W, Th, F, 11½ to 12⅓.

Required of all male students, not specially excused, during the Freshman, Sophomore, and Preparatory years.

Lieutenant Wilson, U. S. A.

2. Tactics.— Lectures and Recitations. Twice a week during the second term, 11½ to 12⅓; Secs. I, II, M, Th; Secs. III, IV, Tu, F.

Lieutenant Wilson, U. S. A.

Required of all Freshmen and non-commissioned officers.

3. Art of War — Lectures and Recitations. Twice a week during the second term, 11½ to 12⅓. Sec. I, M, Th; Sec. II, Tu, F.

Lieutenant Wilson, U. S. A.

Required of all Sophomores, excepting commissioned officers.

PHYSICS AND ELECTRICAL ENGINEERING.

University Hall.

I. PHYSICS.

1. Elementary Physics— Recitations and Lectures. M, Tu, W, Th, F, at 8¼.

First and Second Term.—Five hours a week. An experimental treatment of the elements of physics. Carhart and Chute supplemented by lectures.

Mr. Boyd.

Required in the first year of the Short Course in Mining, and the Course in Clayworking and Ceramics.

2. Physics — Lectures and Recitations. M, W, F, at 9¼.

First Term. — Three times a week. Mechanics and Heat.

Second Term. — Three times a week. Electricity and Magnetism.

Third Term. — Three times a week. Sound and Light.

Professor Thomas.

Required in the Sophomore year of the Courses in Civil Engineering, Mechanical Engineering and Electrical Engineering, and in the Junior year of the Course in Mining Engineering.

3. Physics — Tu, Th, at 9¼.

Three Terms. — Twice a week. Extension of course 2, with practice in solution of problems.

Professor Thomas, Mr. Brown.

Required in the Sophomore year of the Course in Electrical Engineering.

4. Electricity and Magnetism — Lectures and Recitations. M, W, F, at 11½.

First Term. — Three times a week. Mascart and Joubert's Electricity and Magnetism. Fleming's Alternate Current Transformer. Ewing's Magnetism.

Professor Thomas.

Required in the Junior year of the Course in Electrical Engineering.

5. Physical Laboratory.

Second Term. — Elementary manipulation. Length, mass and time measurement. Work in density, elasticity, etc. Work in heat begun. M, Tu, W, 1½ to 4½, credit five hours.

Third Term. — Heat continued. Electricity and Magnetism. Text: Stewart and Gee's Practical Physics. Books of reference: Pickering, Kohlrausch, Glazebrook and Shaw, Ayrton, and others. M, Tu, W, 1½ to 4½, credit five hours.

Professor Thomas, Mr. Boyd, Mr. Brown.

Required in the Sophomore year of the Course in Electrical Engineering.

6. Physical Laboratory — Lectures and Laboratory Work.

First Term. — Sec. I, M, F; Sec. II, W, Th, 1½ to 4½, credit four hours.

Second and Third Terms. — Theory and practice of magnetic and electrical measurement, including the testing and standardizing of instruments; conductivity of conductors; insulation, resistance and capacity of insulated conductors and cables; temperature co-efficients; commercial measuring and testing instruments, etc. Strength and distribution of magnetic fields, magnetic moments, permeability, etc. Work in light, including optical constants; spectroscopy; photometry of gas, electric, and other lights, etc. M, Tu, W, 1½ to 4½, credit five hours.

Professor Thomas.

Required in the Junior year of the Course in Electrical Engineering.

7. Physical Laboratory.

Three Terms.— M, Tu, W, 1½ to 4½, credit two to five hours.

Professor Thomas, Mr. Boyd, Mr. Brown.

Required in Civil and Mechanical Engineering Courses.

Course 7 must be preceded by course 2.

The work in the Physical Laboratory begins with exercises in length, mass and time measurements, making use of scales, tapes and bars, micrometer screws, micrometer microscopes, the dividing engine, the cathetometer, the balance, chronometers, chronoscopes, etc. This course is intended to give the student facility in the use of instruments, and knowledge of the theory of their construction and adjustment. The determination of various physical constants follows, with elementary exercises in heat, light, electricity and magnetism, after which the student takes up such advanced work as his taste and skill permits. The experimental work is accompanied by instruction in methods and in the discussion of results.

II. ELECTICAL ENGINEERING.

Electrical Hall.

2. Electrical Engineering—Lectures.

Three Terms.—First and second terms five times a week, M, Tu, W, Th, F, at 10¼ or 11½; third term three times a week, M, W, F, at 10¼ or 11½. Theory of dynamo-electric machinery, including direct current and alternating current generators and motors; methods of regulation and control; circuits, lamps and auxiliary apparatus; storage batteries; applications of electricity to street car and mine working; design, construction and management of plant, central and isolated; specifications and contracts; law of contracts; rights and liabilities of electric companies, etc., etc.

Professor Thomas, Assistant Professor Caldwell.

Required in the Senior year of the Course in Electrical Engineering.

3. Designing and Drawing.

Three Terms.—First and second terms three times a week, M, W, F, 8¼ to 10¼; third term five times a week, M, Tu, W, Th, F, 8¼ to 10¼. Working drawings of electrical apparatus designed by the students; station, circuit, machine and other technical drawing. Blue-printing, etc.

Assistant Professor Caldwell.

Required in the Senior year of the Course in Electrical Engineering.

4. Electrical Laboratory.

Three Terms.—Three half days per week. Laboratory open M, Tu, W, Th, F, 1½ to 4½, and S, 9 to 12. A full experimental course in the handling and testing of steam and gas engines, dynamos, motors, storage batteries, circuits, instruments, etc. Special courses are given, suited to the preparation and object of the student.

Professor Thomas, Assistant Professor Caldwell.

Required in the Senior year of the Course in Electrical Engineering.

5. Electrical Engineering.

THREE TERMS.—Twice a week. A special course, with work in Physical and Electrical Laboratories.

Assistant Professor CALDWELL.

Required in the Senior year of the Course in Mining Engineering.

PHYSIOLOGY.

UNIVERSITY HALL.

The facilities provided for the study of anatomy, bacteriology, histology, and physiology are excellent. The laboratory is supplied with skeletons, papier-mache manikin, and many models, including models of the eye, ear, larynx, etc. The apparatus of the Department for work in bacteriology and physiology is of the best and most approved construction, and is adapted to the accurate investigation of bacterial forms, as well as to the thorough performance of the fundamental physiological experiments. Myographs, spectroscopes, microscopes, and the necessary chemical outfit are also provided. For work in histology the equipment includes twenty-four individual tables for student experiments, each table being supplied with a good microscope, microscopical accessories, microscopical reagents, and for advanced work, the needed apparatus for instruction in the various methods of hardening, staining, imbedding, section-cutting, and injection. The laboratory also has excellent microtomes, imbedding baths, and other essentials of a histological outfit. The equipment of the laboratory makes it possible to offer a large range of work for the choice of students in advanced courses.

1. Human Anatomy and Physiology — Lectures, recitations, and Laboratory Work.

THREE TERMS.— Lectures, Recitations, and Demonstrations, M,W, F, at 10¼.
Text-book: Martin's Human Body ; or Foster.

Professor BLEILE.

Elective in the Course in Industrial Arts.

SHOPWORK.

HAYES HALL.

1. Carpentery and Pattern-making — Exercises in the principles and practice of carpentery, wood-turning, and pattern-making. First term, M, W, 1½ to 4½ ; second term, Sec. I, M, W, Sec. II, Tu, Th, 1½ to 4½ ; third term, Sec. I, M, W, Sec. II, Tu, Th, 8¼ to 11¼ ; Sec. III, M, W, Sec. IV, Tu, Th, 1½ to 4½.

Professor WILLISTON, Mr. WEICK.

Required in the Freshman year of the Course in Industrial Arts, three terms, three times a week (six hours' practice) ; required in the Freshman year of the Courses in Mechanical and Electrical Engineering, third term, three times a week (six hours' practice) ; required in the Sophomore year of the Course in Mining Engineering, first term, twice a week (four hours' practice).

2. Forging — Exercises in smithwork, including elementary operations of the blacksmith, such as drawing, upsetting, bending, and welding and the making and tempering of steel tools and springs. First term, M, Tu, W, Th, F, 1½ to 4½; second term, Sec. I, 9¼ to 11¼, Sec. II, 1½ to 4½, Tu, Th; third term, M, W, F, 9¼ to 11¼.
Professor Williston, Mr. Combs.

Required in the Sophomore year in the Course in Industrial Arts, three terms, three times a week (six hours' practice); required in the Sophomore year of the Courses in Mechanical and Electrical Engineering, first term, three times a week (six hours' practice); required in the Sophomore year of the Course in Mining Engineering, second term, twice a week (four hours' practice); required in the second year of the Short Mining Course, third term, three times a week (six hours' practice).

3. Foundry Work.— This course will not be given in 1895–96.

4. Chipping and Filing.— Exercises in vise work, including chipping of cast and wrought iron, filing and scraping of accurate surfaces. M, W, Th, F, 2½ to 4½.
Professor Williston, Mr. Knight.

Required in the Sophomore year of the Course in Mechanical Engineering, second term, three times a week (six hours' practice); required in the Sophomore year of the Course in Electrical Engineering, second term, twice a week (four hours' practice); required in the Sophomore year of the Course in Mining Engineering, third term, twice a week (four hours' practice).

5. Elementary Machinery Work.— Exercises in hand-turning in iron and brass on speed lathes, and in turning, boring, fitting and the chasing of threads on engine lathes. First term, W, Th, F, 1½ to 4½; second term, M, Tu, W, Th, F, 9¼ to 11¼; Th, F, 1½ to 4½. Third Term, Tu, Th, 9¼ to 11¼; M, W, Th, F, 1½ to 4½.
Professor Williston, Mr. Knight.

Required in the Sophomore year of the Course in Mechanical Engineering, third term, three times a week (six hours' practice); required in the Sophomore year of the Course in Electrical Engineering, third term, twice a week (four hours' practice).

6. Advanced Machinery Work.—A continuation of course 5 with exercises on the planer, shaper and milling machine, and the making, hardening, and grinding of standard plugs, taps, twist drills, etc. Hours to be arranged.
Professor Williston, Mr. Knight.

Required in the Junior year of the Course in Mechanical Engineering, first term, three times a week (six hours' practice); required in the Junior year of the Course in Electrical Engineering, second term, four times a week (eight hours' practice).

ZOOLOGY AND ENTOMOLOGY.

UNIVERSITY HALL.

The outfit of the Department is ample, consisting of general zoological collections, an entomological collection, a series of skeletons, alcoholic specimens, and all needed instruments.

1. Zoology — Lectures, Recitations and Demonstrations. Three times a week. M, W, at 10¼.

Sec. I, F, at 9¼; Sec. II, at 10¼; Sec. III, at 1½; for two hours.

FIRST TERM.
SECOND TERM. } Lectures and Recitations two hours on Systematic Zoology and Morphology, and one hour devoted to examinations and dissections of types.

THIRD TERM.— Entomology substituted for General Zoology. The same method of study is pursued.

Text-books required: Dodge's Practical Zoology, Comstock's Introduction to Entomology. Recommended for reference: Claus and Sedgwick's Text-book of Zoology, Saunder's Insects Injurious to Fruits, Packard's Forest Insects.

Elective in the Course in Industrial Arts. Professor KELLICOTT.

Admission.

The University is open on equal terms to both sexes.

The entrance examinations for 1895 will be held on Monday and Tuesday, June 10 and 11, and on Monday and Tuesday, September 9 and 10. A part of the examinations may be taken in June and the remainder in September. Conditions incurred at the June examinations must be removed at the September examinations.

Candidates who come from other colleges or universities are required to bring certificates of honorable dismission.

(A.) ADMISSION TO THE FOUR-YEAR COURSES.

Candidates for admission to any of the Courses in Engineering must be at least seventeen years of age, and be provided with credentials of scholarship from their last instructor or from the last institution with which they have been connected.

There are three modes of admission to the Freshman class:

1. Candidates who have, in the Preparatory Department of the University, successfully completed the studies requisite for the Course they desire to enter, are admitted without examination.

2. Certificates of high schools and normal schools in Ohio are accepted, if found satisfactory, in lieu of examination, for preparatory studies, under the following conditions:

(*a*) Each certificate must show that the candidate has completed the course of study in the school from which he comes, and must further contain a detailed statement of the studies pursued, the text books used, the amount of work done in each study, the amount of time devoted to it, the date of the examination, and the rank or standing of the candidate in it. A copy of the course of study should accompany the certificate, and both should be sent to the University not later than the 1st of September.

(*b*) From time to time the Faculty has approved the course of study in certain high schools of the State; and the graduates of these high schools are admitted to Freshman work on presentation of their diplomas, subject, however, to conditions in all required studies not included in their high school course.

3. All other candidates are subject to examination on the group of studies mentioned below under the headings of those Courses in the University which they severally desire to enter. Full equivalents for the text-books named will be accepted.

I. FOR ADMISSION TO THE COURSE IN CIVIL ENGINEERING.

Candidates must be at least seventeen years of age.

The following are the requirements for admission:

1. *Grammar*, *Geography*, and *Arithmetic*.

2. *Algebra.*—Venable's, Wentworth's or Wells's Elements of Algebra, complete, or an equivalent.

3. *Geometry*, *Plane and Solid.*—Wentworth's or Wells's, or an equivalent.

4. *Physics.*— Gage's or Carhart and Chute's Elements of Physics, complete, or an equivalent.

5. *English.*— Genung's Outlines of Rhetoric, or Hill's Elements of Rhetoric, or Hill's Foundations of Rhetoric, or an equivalent; and an essay of about five hundred words, to be written in the presence of the examiner, correct in spelling, grammar, punctuation, capital letters, sentential structure, and paragraphing. The subjects for 1895 will be taken from the following works, with the substance of which — the plots, incidents, characters, etc.— it is expected that the candidate will make himself thoroughly familiar: Shakespeare's Twelfth Night; Scott's Abbot; Irving's Sketch Book; Longfellow's Evangeline. The subjects for 1896 will be taken from Shakespeare's A Midsummer Night's Dream; George Eliot's Silas Marner; Macaulay's Essays on Milton and Addison; Milton's L'Allegro, Il Penseroso, Comus and Lycidas. Equivalents of these will be accepted.

For securing the proper preparation, the following course is recommended: (1.) A few lessons and constant practice in the proper use of the Unabridged Dictionaries. (2.) A thorough mastery of the elements of English Grammar. (3.) Daily recitations for at least one term in some such work as Genung's Outline of Rhetoric. (4.) Weekly exercises in original composition for at least one year. Scott & Denney's Paragraph Writing is recommended to teachers as a guide. (5.) A careful reading of the works enumerated above.

6. *History.*— Johnston's History of the United States, or an equivalent.

7. Any *two* subjects chosen by the candidate from the following:
   - (*a*) *Botany.*— Gray's Lessons preferred.
   - (*b*) *Physical Geography.*—Geikie's preferred.
   - (*c*) *Physiology.*— Martin's (briefer course), or an equivalent.
   - (*d*) *Astronomy* — Young's (for beginners), or an equivalent.
   - (*e*) *Civil Government.*— Fisk's or Thorpe's preferred.
   - (*f*) *General History.*— Myers's preferred.
   - (*g*) *English Literature.*— Pancoast's Introduction to English Literature, or an equivalent.

NOTE.—The work in Geometry, Physics, and Botany, required for admission to the Courses in Engineering and to the Course in Industrial Arts, may be done in the Preparatory Department of the University. The University does not provide preparation in the other subjects required for admission to these Courses.

II. FOR ADMISSION TO THE COURSE IN MINING ENGINEERING.

Candidates must be at least seventeen years of age.

The requirements are the same as for the admission to the Course in Civil Engineering.

III. FOR ADMISSION TO THE COURSE IN MECHANICAL ENGINEERING.

Candidates must be at least seventeen years of age.

The requirements are the same as for admission to the Course in Civil Engineering.

IV. FOR ADMISSION TO THE COURSE IN ELECTRICAL ENGINEERING.

Candidates must be at least seventeen years of age.

The requirements are the same as for admission to the Course in Civil Engineering.

V. FOR ADMISSION TO THE COURSE IN INDUSTRIAL ARTS.

Candidates must be at least sixteen years of age.

The requirements are the same as for admission to the Course in Civil Engineering.

(B) ADMISSION TO THE SHORT COURSES.

For admission to these Courses high school diplomas or teachers' certificates, good for at least one year, will be accepted in lieu of examination. Teachers' certificates must be valid at the time they are presented.

(I) FOR ADMISSION TO THE SHORT COURSE IN MINING.

Candidates are examined in orthography, grammar, geography and arithmetic; but those who are over twenty-one years of age are admitted without examination.

(II) FOR ADMISSION TO THE COURSE IN CLAYWOKING AND CERAMICS.

Candidates must be not less than sixteen years of age, and, unless they are over twenty-one years of age, must pass an examination in arithmetic, geography, grammar and orthography.

(C) ADMISSION TO SPECIAL STUDIES.

Students who desire to pursue special lines of work in the Engineering Departments of the University, and do not desire to become candidates for a degree, will be admitted on the following conditions:

1. They must secure admission to the Freshman Class in the regular manner. But applicants who are not less than twenty-one years of age, after obtaining credit for orthography, English grammar, geography, arithmetic, history of the United States, and such other subjects as may be necessary to qualify them for the classes that they wish to enter, may, on the presentation of satisfactory reasons, be admitted by the proper committee to any class in the University; provided, that if any student who has been admitted on these conditions afterwards becomes a candidate for a degree, he shall take the omitted examinations required for admission to the Freshman year, at least twelve months before the degree is conferred. For the Courses in Mechanical and Electrical Engineering the limit of age for such applicants is eighteen years instead of twenty-one.

2. They must lay before the proper committee for approval or modification, a written statement of the end they have in view, the studies proposed for the attainment of that end, and the probable period of attendance. Special students will be held as strictly to their accepted schemes of work as are the regular undergraduates to their course of study. Permission to enter as special undergraduates will be refused to all of whose definiteness of purpose the committee fails to receive satisfactory evidence, and will be withdrawn whenever the conditions on which it was granted cease to exist.

(D) ADMISSION TO ADVANCED STANDING.

1. Candidates who do not come from some other university or college must first obtain admission to the University in the manner already described; they will then be examined on such undergraduate studies as they may ask to be credited with in advance.

2. Candidates who come from the collegiate department of an approved college, and who bring explicit and official certificates describing their course of study and scholarship, and also certificates of honorable dismission, will be admitted without examination, except such as may be necessary to determine what credit they are to receive here for work done in the college from which they come.

(E) ADMISSION TO GRADUATE WORK.

Graduates of this or other institutions may, on application to the Faculty, enter the University and pursue such lines of work as may be arranged or approved by the appropriate collegiate committee. Such graduate students are subject to all the ordinary regulations (as to fees, attendance, etc.) prescribed for undergraduates.

REGISTRATION.

All students are required to register and pay their term fees on the first day of each term, between the hours of 8:30 A. M. and 12 M., or between 1:30 and 4:30 P. M., central standard time.

Former students who fail to register on this day will be charged one dollar in addition to the usual incidental fee, for the first day of delinquency, and fifty cents additional for each subsequent day.

No candidate for graduation will be permitted to register for the second term of his graduating year except upon presentation to the Bursar of the President's certificate that his thesis subject has been announced and approved.

MATRICULATION.

Each regular undergraduate, on being admitted to the college classes, will sign the matriculation book, and will be certified by the President or Secretary of the Faculty to the secretary of the appropriate committee, with a statement of the Course and class to which he is admitted, and what conditions, if any, are imposed.

Each special undergraduate, on being admitted to the work of the college classes, will sign the matriculation book, and will be certified to the proper secretary.

RULES AND REGULATIONS.

AMOUNT OF WORK.

No student is permitted to take less than fifteen or more than eighteen hours a week of class-room work, except by special permission of the committee of the School in which he is enrolled; and no student will be permitted to take more than the regular work of the class to which he belongs, who has not passed all his work for the preceding term.

ELECTIVE STUDIES.

All elections of work in continuous studies, when once made, are understood to be made for the entire collegiate year.

The right is reserved to withdraw the offer of any elective study when it is not chosen by at least four persons.

EXAMINATION AND STANDINGS.

At the close of each term students must obtain credit for two-thirds of their work for the term in order to retain their connection with the University; but if students who have not passed in the requisite amount of work can make good their deficiency by the removal of conditions, they may do so at the beginning of the following term, and thus reinstate themselves.

Students reported at the end of any term as failed in one-half their work, forfeit their connection with the University.

DEGREES.

The degree of Civil Engineer is conferred on those who have completed the Course in Civil Engineering; that of Engineer of Mines on those who have completed the Course in Mining Engineering; that of Mechanical Engineer on those who have completed the Course in Mechanical Engineering or that in Electrical Engineering.

The degree of Bachelor of Science in Industrial Arts is conferred on students who have completed the Course in Industrial Arts.

Except by unanimous consent of the Faculty, no candidate for graduation will be recommended for a degree, whose record is not in all respects complete by the Friday evening previous to the Commencement Day on which he seeks the degree.

General Information.

UNIVERSITY LIBRARY.

THE GENERAL LIBRARY is located in Orton Hall, the east end of that building having been designed for its use until a separate building can be erected. This library contains about 13,000 bound volumes and 7,000 pamphlets, and is a circulating library for officers and students of the University.

The library hours are from 8 A. M. until 5 P. M. on all week days during term time; from 9 A. M. until 12 M. during the holiday vacation, and during the summer vacation, two afternoons of each week, legal holidays being excepted.

TERMS AND VACATIONS.

The first term of each college year begins on Wednesday following the tenth day of September, and closes on the Wednesday preceding Christmas. The second term begins on the Wednesday following the first day of January, and closes on the Friday following the twenty-first day of March. The third term begins on the Monday following the close of the second term, and closes on Commencement Day, which is the Wednesday following the eleventh day of June.

Regular college exercises are omitted on Thanksgiving Day and the day following, on the twenty-second day of February, and on Memorial Day.

EXPENSES.

FEES.

I. COLLEGIATE DEPARTMENT AND PREPARATORY DEPARTMENT.

INCIDENTAL FEE.— A charge of five dollars a term, or fifteen dollars a year, is made against all students, under the head of incidental expense. In the case of former students, if this fee is not paid until the second day of the term, one dollar will be added, and for each succeeding day of delinquency fifty cents will be added.

Laboratory Fees.— Students in the laboratories and shops are required to pay fees to cover, in part, the cost of the materials consumed, and the deterioration of the expensive instruments used by them. The fees charged per term in the laboratories mentioned below are as follows:

Laboratory of Physics, five hours a week	$7 00
Laboratory of Physics, two or three hours a week	5 00
Mechanical Laboratory	5 00
Shops	7 00
Laboratory of Clayworking and Ceramics	5 00

In the laboratories of the Departments of General Chemistry, Agricultural Chemistry, and Metallurgy each student is required at the beginning of each term to pay a fixed charge of one dollar and fifty cents for gas and water. He is also required to buy his own supplies, as he needs them, at the general storeroom in Chemical Hall where laboratory supplies are sold to students at first cost to the University.

All term dues must be paid at the opening of each term as a condition of admission to classes.

Graduation Fee.— A fee of five dollars to cover expenses of graduation, diplomas, etc., is required of each person receiving one of the ordinary degrees from the University, and this fee must be paid before the degree is conferred. A like fee of ten dollars is charged to each person receiving one of the higher or graduate degrees.

OTHER EXPENSES.

There are two dormitories on the University grounds for the use of students. Each occupant is charged by the University a rent of one dollar and fifty cents a term.

The South Dormitory affords unfurnished rooms to such students as desire to board themselves, and thus to reduce their expenses to a minimum. Twenty students can be accommodated in this building, two students being assigned to each room. The expense of living in this way falls below two dollars per week. Applications for rooms should be made to the President of the University.

The North Dormitory will accommodate more than sixty students. It is, for the present, turned over to the University Club. Board, furnished rooms, fuel, light and washing are, at present prices, supplied for about three dollars and twenty-five cents a week. New students will not, however, be admitted without special recommendation to the President of the University, and by him to the club. A student who occupies a room in either dormitory at the close of a collegiate year has a preferred claim for the next year; but when a student has once relinquished his room he can re-enter the dormitory only on the recommendation of the President of the University, and under the same conditions as a new student.

Boarding clubs are also formed in the neighborhood of the University. Several such clubs have been organized with very satisfactory results. Furnished rooms are rented at seventy-five cents to one dollar a week for each student, and the cost of board is two dollars to three dollars a week.

Board, with furnished rooms, can be obtained in private families, within convenient distances of the University, at rates varying from four dollars to five dollars a week. The ruling rate may be taken as four dollars and fifty cents.

The uniform with which the members of the battalion are required to provide themselves costs about twenty-three dollars.

The expenses of a student in the Collegiate Department for a year may be estimated as follows, excluding clothing (except uniform) and traveling expenses:

	Low.	Moderate.	Liberal.
Incidental fees	$15 00	$15 00	$15 00
Laboratory fees	.....	15 00	54 00
Books and stationery	15 00	25 00	40 00
Room	4 50	37 00	75 00
Furniture	10 00	......	......
Board	70 00	110 00	150 00
Uniform	20 00	22 50	25 00
	$134 50	$224 50	$359 00

The second and third estimates for room include light, fuel and care. The third estimate is for a room occupied by a single student. The requirements for laboratory fees and books depend upon the course of study pursued.

LITERARY, ECONOMIC, AND SCIENTIFIC SOCIETIES.

The Alcyone Literary Society, open to male students, was founded in 1874, and the Horton Literary Society, open to male students, was founded in 1875. These societies have commodious and well furnished apartments in University Hall. The Browning Literary Society founded in 1883, and the Philomathean Literary Society founded in 1894, are open to the young women students only. These societies meet weekly, and their work, offering to the student a very desirable training in composition, public speaking, and parliamentary order, is a valuable adjunct to collegiate education. The Newman Literary Society, membership in which is open to Catholic students, was organized in 1892, and holds its meetings bi-weekly.

The Chemical Association is an organization of professors and students for mutual assistance and improvement in the line of chemical science. Its meetings are regularly held every two weeks, at which papers are read, notes of observation and research presented, and current chemical literature discussed,

The Engineering Society is a similar organization of students and instructors, holding meetings bi-weekly, for the consideration of questions in the various branches of engineering.

MILITARY SCIENCE AND TACTICS.

Under the law of Congress establishing the University, it is required that instruction shall be given in military science and tactics. In accordance with this provision, an officer of the regular army has been detailed to take charge of the Department of Military Science and Tactics; and the Trustees have directed that all male students, except those in the Law School, seniors and juniors in the Collegiate Department, and such others as may be specially excused, shall be enrolled in the battalion. A uniform has been prescribed, with which each member is required to provide himself; and fifty minutes a day are devoted to drill, except on those days when instruction in tactics is given.

Directory of the Alumni

OF THE ENGINEERING SCHOOL.

Akerman, Eli Osborne, 1884, C. E., 2664 North High street, Columbus, O., farmer.

Ackerman, Fremont, 1883, C. E., Los Angels, Cal., civil engineer.

Alexander, St. Clair, 1893, M. E., Bridgeport, O.

Alsdorf, Frederick Charles, 1892, E. M., Creighton, Georgia, with Creighton Mining and Milling Co.

Beck, Arthur Andrew, 1893, C. E., Columbus, O., county surveyor's office.

Bissing, William, 1893, M. E., Washington, D. C., patent office.

Bloom, J. George, 1889, C. E., Cincinnati, O., assistant engineer B. & O. S. W. R'y.

Bradford, Joseph Nelson, 1883, M. E., 54 West Tenth avenue, Columbus, O., associate professor of drawing Ohio State University.

Brown, Frederick W., 1888, E. M., Bellefontaine, O., superintendent Buckeye Portland Cement Co.

Brown, Newton H., 1893, M. E., Columbus, O., assistant in physics, Ohio State University.

Burns, James Ferguson, 1891, C. E., Guthrie, Ky., assistant engineer L. & N. R. R.

Capron, Marshall Fremont, 1888, M. E., Kenton, O., architect.

Carroll, Patrick Henry, 1894, E. M., Houtzdale, Pa.

Cellarius, Frederick Julius, 1888, C. E., room 3, city building, Dayton, O., assistant city civil engineer.

Cole, George Narthan, 1891, M. E., 897 Franklin avenue, Columbus, O., superintendent Bradstreet's Commercial Agency.

Connell, William A., 1886, E. M.

Cunningham, Edward Walter, 1894, C. E., Urbana, O.

Davis, Charles William, 1894, E. M., Columbus, O., fellow in mining and metallurgy Ohio State University.

Dun, John J., 1883, E. M., Fifteenth avenue, Columbus, O., county surveyor.

Erskine, John H., 1886, E. M., Lowellsville, O., fire brick manufacturer.

Evans, Peter Platter, 1892, C. E., 226 Dennison avenue, Cleveland, O., engineer C. L. & W. Railway.

Feicht, Russel Stimson, 1890, M. E., 632 N. Sixteenth street, Philadelphia, Pa., Philadelphia Traction Co.

Floto, Julius, 1889, E. M., P. O. box 332, Cincinnati, O., sales agent.

Flynn, Harry Franklin, 1892, C. E., Washington, D. C., computer U. S. Geodetic Coast Survey.

Foster, Frank McMillan, 1894, M. E., Omega, O.

Fravel, George B., 1888, M. E., Indianapolis, Ind., assistant master mechanic Pan Handle shops.

Gehrkens, Edward Frederick, 1894, E. E., Schenectady, N. Y., with General Electric Co.

Goddard, Loring Hapgood, 1892, C. E., East Seventh avenue, Columbus, O., civil engineer and architect.

Goodell, Ralph Spencer, 1892, C. E., 44 Lincoln street, Columbus, O., draughtsman, Columbus Bridge Co.

Green, Jerome Joseph, 1893, M. E., Columbus, O.

Gregory, Hiram D., 1880, E. M.

Hall, Harry R., 1889, E. M., Parryville, Pa., superintendent Carbon Iron and Pipe Co.

Harrison, William Henry, 1885, C. E., Anaconda, Montana.

Hartwell, Arthur, 1888, M. E., Pittsburg, Pa., electrical engineer, Westinghouse Electrical and Manufacturing Co.

Hassler, Robert Hanitch, 1892, M. E., Pittsburgh, Pa., Westinghouse Electrical and Manufacturing Co.

Hayward, George E., 1893, C. E., New Philadelphia, O., engineer, C. L. & W. Railway.

Hazlett, Robert, Jr., 1887, C. E., Wheeling, W. Va., civil engineer.

Heller, Albert Henry, 1890, C. E., bridge draughtsman, Youngstown, O.

Hine, Lucius A., 1888, E. M., Chicago, Ill., Chicago Electric Co.

Hunt, William Franklin, 1887, M. E., St. Paul, Minn., attorney-at-law.

Jenkins, William B., 1893, C. E., Wilmington, O.

Jenkins, Willis H., 1894, C. E., New York City.

Johnson, George Edward, 1892, C. E., Columbus, O., 67 E. State street, N. & W. Railway.

Johnson, Herbert Lincoln, R. M. E., 40 Everett street, Cincinnati, O., General Electric Co.

*Jones, A. A., 1886, C. E., died May, 1894.

Jones, Pearl N., 1892, M. E., Pittsburgh, Pa., Westinghouse Electrical and Manufacturing Co.

Jones, Smiley, 1894, E. M., Downieville, Cal., electrician Gold Bluff mine.

Keffer, Frederic, 1882, M. E., 161 Orchard street, Elizabeth, N. J., chemist.

Kemmler, Edward A., 1888, C. E., 895 South High street, Columbus, O., assistant in civil engineering, Ohio State University.

Kerr, Samuel Thompson, 1894, M. E., Cleveland, O., with the Elliott-Lincoln Electric Co., 1120-1130 Payne avenue.

Kiesewetter, Frank Louis, 1891, C. E., South High street, Columbus, O., Ohio State Savings Bank.

Lamme, Benjamin G., 1888, M. E., Pittsburgh, Pa., engineer, Westinghouse Electrical and Manufacturing Co.

Lamme, Bertha A., 1893, M. E., Pittsburgh, Pa., Westinghouse Electrical and Manufacturing Co.

Large, Joseph H., 1890, C. E., Pittsburgh, Pa., assistant inspector of bridges, Pennsylvania Southwest system.

Levering, Orpheus D., 1893, M. E., Columbus, O., Capital City Machine Co.

Lincoln, Paul Martyn, 1892, M. E., Pittsburgh, Pa., Westinghouse Electrical and Manufacturing Co.

Lovejoy, Ellis, 1885, E. M., Union Furnace, O., chemist and superintendent Columbus Brick and Terra Cotta Co.

Mackey, Ure LaVerne, 1893, M. E. (B. A. Wooster University), Allegheny, Pa., student in United Presbyterian Theological Seminary.

Manley, Rush Emmett, 1894, M. E., Presho, O.

Martin, Percy, 1892, M. E., with Ludw. Loewe & Co., Martinikenfelde, Kaiserin Augusta Allee, Berlin, N. W. Germany.

Marvin, Charles Frederick, 1883, M. E., Washington, D. C., U. S. Weather Bureau.

Masters, George Albert, 1886, C. E., Chicago, Ills., civil engineer.

McAllen. William Johnson, 1894, C. E., Fannettsburg, O.

McCormick, J. H., 1880, M. E., West Fulton street, Columbus, O., civil engineer.

McGuffey, Francis Hoyt, 1894, M. E., graduate student Ohio State University, Columbus, O.

Menough, Arthur George, 1894, E. M., Wellsville, O.

Mershon, Ralph D., 1890, M. E., Pittsburgh, Pa., Westinghouse Electrical and Manufacturing Co.

Miller, Frank Case, 1893, C. E., 587 Lilley avenue, Columbus, O., assistant engineer C., S. & H. Short Line Division.

Miller, Harry Franklin, 1889, M. E., Detroit, Mich., heating and ventilating engineer.

Morrison, Robb O., 1893, C. E., Columbus, O., U. S. Survey of Ohio and Erie canal.

Morton, George L., 1884, M. E. (LL. B., National Law School, patent office, Washington, D. C., first assistant examiner department electricity.

Munn, Mortiner Adam, 1894, C. E., Bowling Green, O.

Myers, Roy V,, 1893, C. E., New Straitsville, O., with Columbus and Hocking Coal and Iron Co.

Myers, Uriah H, 1887, E. M , 206 South Third street, Steubenville, O., chemist Jefferson Iron Works.

O'Brine, David, 1881, B. Sc., M. Sc., E. M., D. Sc., M. D., 231 West Church street, Urbana, O., physician.

Orton, Edward, Jr., 1884, E. M., 36 North Monroe avenue, Columbus, O., director of the department of clayworking and ceramics Ohio State University.

Palmer, Walter K., 1893, M. E., Crozet, Va., professor of mechanical drawing.

Payne, Halbert Edwin, 1887, M. E., Erie, Pa., manufacturer.

Pearl, Allen Sexton, 1894, M. E., Berlin Heights, O.

Pedlow, Edward Benjamin, 1893, C. E., New Straitsville, O., chief engineer Columbus and Hocking Coal and Iron Co.

Pence, David Arrel, 1894, M. E., Lowellville, O.

Peters, William Lincoln, 1885, M. E., Riverside, Cal., manufacturer.

Pleukharp, Chas. V., 1885, M. E , Columbus, O., pastor South High street M. E. Church.

Postle, Herman R., 1894, C. E., Harrisburg, O.

Powell, Charles S., 1893, E. E., Pittsburgh, Pa., Westinghouse Electrical and Manufacturing Co.

Ray, Frank A., 1887, E. M., Columbus, O., assistant professor of mining engineering Ohio State University.

Ray, William M., 1893, C. E., New Philadelphia, O., C. L. & W. Railway.

Raymond, Coles Abel, 1894, C. E., Toledo, O., Toledo Bridge Works.

Reeves, Archibald C., 1887, C. E., Dayton, O., assistant city civil engineer.

Robinson, Erdus Geroska, 1893, C. E., Columbus, O.

Root, Willis J., 1885, E. M., Columbus, O., chemist for King, Gilbert & Warner Steel Works.

Schaub, Edward Louis Tascher, 1885, M. E., Columbus, O., with P. C. & St. L. R. R.

Scheibell, William O., 1888, E. M., Harper, O., chemist, Buckeye Portland Cement Co.

Schroll, Otto, 1886, C. E., Wheeling, W. Va., civil engineer.

Serva, Adam A., 1893, M. E., Canton, O.

Sharp, Charles C., 1888, C. E., Corning, O., superintendent mining department Sunday Creek Coal Co.

Sherman, Christopher Ellis, 1894, C. E., Columbus, O., U. S. Survey of Ohio and Erie Canal.

Skinner, Chas. E., 1890, M. E., box 435, Wilkinsburg, Pa., Westinghouse Electrical and Manufacturing Co.

Sperr, Frederick W., 1883, E. M., Houghton, Mich., professor of civil and mining engineering, Michigan School of Mines.

Stinebaugh, Isaac Long, 1892, C. E., Tiffin, O., 379 Sandusky street, Tiffin Inter-Urban Electric Railway.

Storer, Norman Wilson, 1891, M. E., Pittsburgh, Pa., Westinghouse Electrical and Manufacturing Co.

Storer, Simon B., 1893, M. E., Pittsburgh, Pa., Westinghouse Electrical and Manufacturing Co.

Stull, Emmett Willet, 1894, M. E., Elkland, Pa., electrician.

Taylor, Arthur W., 1893, E. M.

Tomlinson, James Rowe, 1892, C. E., Pottsville Iron and Steel Co., Pottsville, Pa.

Towne, Robert S., 1879, B. Sc., E. M., 20 Nassau street, New York, N. Y., president Mexican Northern Railway.

Turner, Arthur M., 1893, M. E., Trinidad, Col., banker.

Vandevoort, William P., 1886, E. M., Morrow, O., principal of high school.

Viets, Willis B., 1886, E. M., chemist, Cleveland, O.

Wadsworth, F. L. Olcutt, 1888, B. Sc., E. M., M. E., Chicago, Ill., assistant professor of physics, University of Chicago.

Watt, Sern P., 1886, M. E., Ft. Wayne, Ind.

Welch, Clark J., 1888, C. E., Youngstown, O., bridge engineer.

Zaumzeil, Oscar C., 1887, C. E., 126 Seely avenue, Chicago, Ill., architect.

Zurfluh, William Nicholas, 1894, M. E., Toledo, O.